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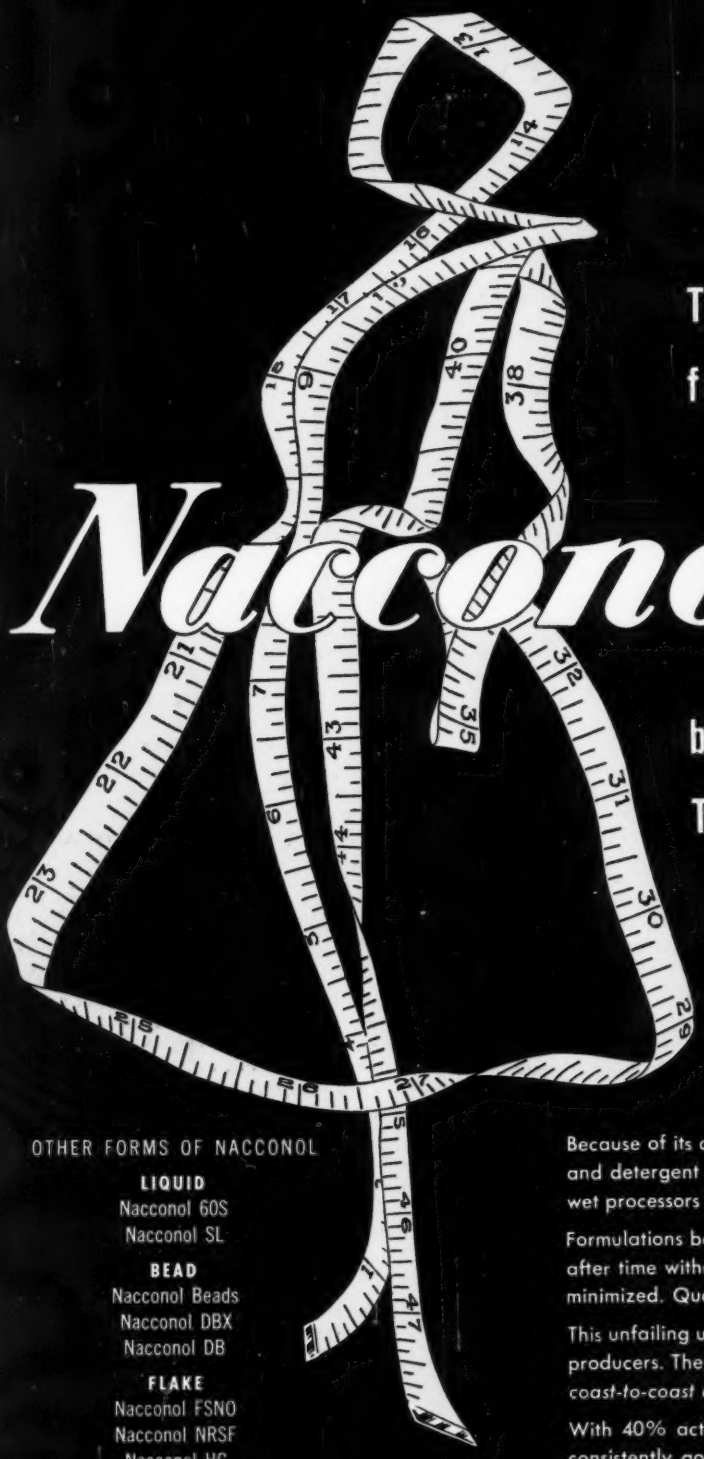

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AMERICAN

DYESTUFF REPORTER

Volume 48 February 23, 1959 Number 4

REACTIONS OF FORMALS AND POLY(FORMALS) WITH CELLULOSE

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It has been found that acetals may be used to reduce swelling of cellulosic fibers, thus reducing shrinkage of cellulose fabrics so treated. A novel class of poly (oxyalkylene formals) is described and its use in textile treatment for this purpose is shown. It is suggested that, in reaction between the poly(formal) and cellulose, transacetalization takes place.

INTRODUCTION

THE action of formaldehyde on cellulosic fibers was described by Eschalier over fifty years ago (*5, 6, 16*). Studies made subsequently showed that the most likely mechanism was the formation of methylene bridges between cellulose chains (*10, 24*). This type of crosslink, essentially an ether or formal, exhibits the general resistance of ethers to hydrolysis. Conditions for cleavage of this type of linkage are considerably more drastic than those required to split the N-methylene bridges obtained by interaction between cellulose and urea or melamine-formaldehyde condensation products (*4, 8, 9, 11, 19*).

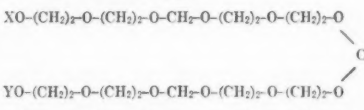
Attempts have been made to use the Eschalier reaction commercially, but the volatility of formaldehyde renders this process obnoxious and inefficient. An attempted solution lies in the use of less volatile aldehydes, such as glyoxal (*21, 22*). Other means for the formation of methylene bridges have now been investigated.

FORMAL REACTANTS——In order to achieve a formal crosslink in cellulose, while avoiding the disadvantages of formaldehyde, we initiated studies utilizing formaldehyde derivatives.

Simple acetals of formaldehyde are readily synthesized by reaction of formaldehyde with two moles of alcohol in the presence of an acid or metallic halide catalyst. These compounds are quite stable to alkaline or neutral hydrolysis, but are readily hydrolyzed in the presence of dilute aqueous acids.

In order to use simple procedures, we investigated water-soluble formals. These were applied at various concentrations in conjunction with a number of acidic catalysts. Among the compounds applied were dioxolane, the formals of beta methoxy-ethanol and beta methoxy-ethoxy-ethanol; and glyceryl formal (mixture of alpha and beta) and a polyformal.

Exploratory investigation showed that a product prepared by condensation of diethylene glycol and paraformaldehyde in the presence of sulfuric acid as a catalyst was of interest (*13*). Evaluation of the properties of this product as a reactant for the control of shrinkage in rayon gabardine indicated its usefulness for further study. The composition of this poly (oxydiethyleneformal) may be represented by:



where X and Y may be either H- or $-CH_2OH$. The product is a solid, melting somewhat above 30°C, but capable of considerable supercooling before crystallization. Other properties are described in the experimental portion.

Reduction of fiber swelling correlates directly with cross-linking of regenerated cellulose (*16*). The shrinkage of standard textile samples under standard conditions was chosen as the parameter which could be studied most readily (*18, 22, 23*) in order to obtain a measure of the swelling. Fabric was treated in the manner described in the experimental section by dyeing and curing in presence of an acidic catalyst. The fabric was then tested for tensile strength (*7*) after washing. Shrinkage was determined by a standard procedure (*1*) after one or more launderings at 100°C. The results are shown in Table I.

Data on fixation of formalin are given in Table X.

Because of the volatility of dioxolane, the quantity used represented the minimum concentration that could yield reproducible results in shrinkage control. The formals of the polyols were more effective in reducing shrinkage of fabric.

The retention of the formaldehyde by the fabric was studied. Rayon challis was treated with various formals using a mixture of one part of zinc chloride to four parts of diglycolic acid as a catalyst, dried at 85°C and cured at 157°C for five minutes. After curing, the fabric was scoured and dried by standard procedures.

TABLE I
Effect of formals on dimensional control of viscose gabardine

*Compound applied**	%	*% HCHO** available*	*Laundering warp shrinkage*		*Lbs tensile strength*
			One cycle	*Five cycles*	*Five cycles*
Dioxolane	13.3	5.4	5.3	5.5	70.0
Formal of methoxy-ethoxy-ethanol	8.5	1.0	4.8	7.0	73.0
Formal of methoxy ethanol	5.5	1.0	4.2	4.2	81.5
Glyceryl formal***	4.0	1.2	2.2	3.5	74.5
Poly (oxydiethylene-formal)	4.5	1.1	2.2	2.4	80.5
Untreated	0	0	8.5	13.6	79.5
Water blank with catalyst only	0	0	3.0	3.5	30.0

*Catalyst: $Na_2SO_4.12H_2O$, $NaHSO_4$, 1:4 ratio; conc 3%. 100% Wet Pickup. Heated 157°C for five minutes after drying at 85°C.
**On fabric before cure. Calculated as amount available upon hydrolysis of compounds.
***Mixed alpha and beta isomers.

TABLE II
Efficiency of formaldehyde binding: viscose challis

Compound*	Formaldehyde % applied	Formaldehyde % bound	Binding efficiency %
5% Glyceryl formal**	1.44	0.21	14
3.5% Poly (oxydiethyleneformal)	0.89	0.30	34

*Catalyst: 2% zinc chloride diglycolic acid mixture, 1:4 ratio, fabric dried at 85°C, cured at 157°C for five minutes.
**Mixed alpha and beta isomers.

TABLE III
Efficiency of formaldehyde binding: viscose challis
Compound: 3.5% diethylene glycol poly(formal)

% Catalyst*	% HCHO Applied	% HCHO Bound	% Binding efficiency
0.5	0.89	**	0
1.0	0.89	0.19	22
2.0	0.89	0.30	34
3.0	0.89	0.40	45

*Catalyst: zinc chloride, diglycolic acid, 1:4 ratio, dried at 85°C, cured at 157°C for five minutes.
**Indeterminate.

Bound formaldehyde was determined by the procedure described in the experimental section. The results are shown in Tables II and III.

As the catalyst concentration was increased, formaldehyde binding efficiency was increased in the application of poly(formal) reactants. Correlation was sought between physical effect on viscose fabric and amount of formaldehyde bound in the fabric. These results are shown in Table IV. In this study, catalyst concentrations were chosen which gave optimum shrinkage control.

The results in Table IV indicate that low concentrations of reactant may bring about good dimensional control.

In the course of evaluation of the effects of the poly(formal), a study was made to determine whether the alkylene glycol portion was also retained as a permanent portion of the condensation in cellulose. A modification of some published procedures for the recovery of glycol was undertaken. An appreciable portion of the theoretically applied diethylene glycol (as polyformal) could be recovered and identified.

TABLE V
Weight gain of viscose rayon by reaction with poly(formal)*

Poly (formal) % Applied	Diethylene glycol % Applied	% Weight gain of fabric** One washing***	% Weight gain of fabric** Repeated washing
10.0	0.0	+6.43	+5.72
0.0	0.0	−0.55	−0.38
0.0	10.0	−0.17	—

*Weight gain according to Gruntfest and Gagliardi (*10*).

% HCHO applied	% Weight gain
2	0.45, 0.35
5	1.36, 1.42

**Cured at 157°C with 10% sodium sulfate: sodium bisulfate catalyst in all trials. The total formaldehyde content of this application represents 2.54% (100% wet pickup).
***After curing, rinsing and drying.

The weight gain of treated fabric was compared with the gain by diethylene glycol treatment. This is shown in Table V.

The results indicate add-on over and above methylene ether formation in cellulose. Comparison with data by Gruntfest and Gagliardi (*10*) on viscose rayon indicates permanent add-on of material other than formaldehyde.

Once formed, under appropriate conditions, the formaldehyde links are resistant to alkaline or neutral hydrolysis. Textile pieces scoured after treatment were analyzed for formaldehyde content and subsequently washed at 100°C. The results are shown in Table VI.

In order to show correlation between individual fiber swelling and treatment, we made studies on rayon raw stock. The fibers were treated with diethylene glycol poly(formal) and catalyst. Samples were dried in a stock drier and some samples were cured at 150°C. These results, shown in Table VII, indicate that reduction in fiber swelling occurs.

Curing at 85°C effected a partial reduction of swelling, indicating that fibers are more reactive than fabric. In similar experiments, rayon staple fabric was treated with a 5.0% of poly(formal) and 3% zinc chloride-diglycolic acid combination. Examination of individual fibers removed from the fabric showed reduction in fiber swelling similar to the results shown in Table VII for cures at 150°C.

TABLE VII
Rayon raw stock*

Treatment	Catalyst	Temperature cured	Fiber diameter % Expansion
None	6% $MgCl_2.6H_2O$	85°C	59.0
4.2% Poly (formal)	"	150°C	38.0
" "	6% $MgCl_2.6H_2O$	85°C	21.8
	1% formic acid		
" "	6% $MgCl_2.6H_2O$	150°C	13.3
	1% formic acid		

*15-Denier 3" bright carpet staple.

TABLE VI
Durability of formaldehyde content

Fabric	Poly (formal) % Applied	% Formaldehyde content after laundering: One cycle *	Five cycles **	30 cycles **
Rayon	4.5	0.66	0.63	—
Light cotton denim	3.5	0.22	—	0.23

*41° C **100° C

CATALYSIS——The type and quantity of catalyst were varied to determine effective conditions. The following catalysts, among others, proved effective for viscose rayon: sodium sulfate-sodium bisulfate mixture (1:4 ratio), oxalic acid, aluminum salts, magnesium chloride hexahydrate and zinc chloride-diglycolic acid mixtures (1:4 ratio). Magnesium chloride proved to be effective for cotton. Typical results are shown in Table VIII.

Variation in catalyst concentration in order to effect shrinkage control is shown. The effect of catalyst alone indicates the tensile preserving effect of the poly(formal). Thus, although a good measure of dimensional control could be obtained with catalyst alone, a severe loss in fabric tensile strength resulted.

DYE RECEPTIVITY AND CREASE RECOVERY——It was not unexpected that cellulose fabrics treated with poly(formal) showed resistance to dyeing by direct cotton dyes. Conversely, disperse dyes had greater effect on these treated fabrics than on untreated cotton or rayon fabrics.

Crease recovery as determined by the Monsanto procedure (*2*), is enhanced by poly(formal) treatment. Thus, 80-square cotton sheeting averages about 160° (sum of warp and fill) on untreated and about 200° on treated fabric. Moderate increase in

TABLE IV
Relationship of formaldehyde binding and physical properties*

Poly(formal) % Applied	% HCHO Applied**	% HCHO Bound	% HCHO Efficiency	% Warp shrinkage One laundering 100°C	Warp tensile lbs
0.0	0	0	0	10.1	73.5
1.5	0.38	.15	39.4	3.9	65.0
2.4	0.61	.30	49.2	2.3	71.0
3.5	0.89	.43	48.3	2.3	71.0
4.5	1.14	.76	66.6	2.4	72.0
10.0	2.54	1.30	51.2	2.7	73.5
14.9	3.78	1.91	50.6	2.9	74.0

*Optimum catalyst and curing conditions.
**Available in compound.

TABLE VIII
Comparison of catalysts

Rayon gabardine cured 157°C/five minutes after drying at 85°C. 100% wet pickup

Catalyst	%	% Warp shrinkage 100°C laundering: One cycle	% Warp shrinkage 100°C laundering: Five cycles	Warp tensile, lbs Five cycles
4.5% Poly(formal) as reactant				
Diglycolic acid $ZnCl_2$	1.6 0.4	2.0	3.1	73.3
Diglycolic acid $ZnCl_2$	3.2 0.8	0.2	0.2	67.8
Water control		10.7	14.5	81.0
No reactant present				
Diglycolic acid $ZnCl_2$	1.6 0.4	1.9	sample disintegrated	0
Oxalic	1.0	3.3	3.6	34.5
Sodium sulfate Sodium bisulfate	0.6 2.4	3.7	3.9	51.8

crease recovery is also obtained in treated viscose fabric. It was also found that durable mechanical effects could be imparted to cellulose fabrics with poly(formal) treatment *(14, 15)*.

PAPER——The poly(formal) of diethylene glycol was applied to a bleached sulfite paper of intermediate freeness containing little size. The results in the enhanced wet strength are shown in Table IX.

Paper treated with poly(formal) reveals limited swelling in transverse to machine direction when exposed to high humidities of 90-100%. Untreated paper shows its maximum expansion under these conditions. This phenomenon is similar to the expansion of rayon and cotton fiber *(3, 18)*.

EXPERIMENTAL PROCEDURES

FORMALS——Dioxolane and the formals of 2-methoxy-ethanol and of 2-methoxy-ethoxy ethanol were obtained through the courtesy of Union Carbide Chemical Co.

Alpha and beta glycerol formal (4-hydroxymethyl dioxolane and 5-hydroxymetadioxane) were prepared by refluxing molar portions of synthetic glycerine and paraformaldehyde in the presence of 40 g of toluene and 0.1 g of p-toluene sulfonic acid and azeotroping one mole of water of reaction in a Dean and Stark apparatus. Sodium acetate was added to neutralize the catalyst and the toluene was evaporated at a vacuum of 25 mm Hg. The viscous liquid was used as obtained.

POLY(FORMAL) OF DIETHYLENE GLYCOL——A mole each of diethylene glycol and paraformaldehyde were refluxed in the same manner as described above in presence of 0.1 g of p-toluene sulfonic acid and 40 g of toluene. When a mole of water of reaction had been removed and catalyst neutralized, the toluene was evaporated in vacuo. Molecular weight 480 (Rast); hydroxyl equivalent 220; specific gravity 1.155 at 23.5°C and N_D^{30} 1.462. The viscous light-straw liquid set to a low melting, white soft wax. The product is completely soluble in toluene and in water and insoluble in aliphatic hydrocarbons.

TABLE IX
Enhancement of wet strength of paper by poly(formal) treatment

% Poly(formal)	% Catalyst	% Wet strength
0	0	2.6
0.7	2.0	29.5
2.1	2.0	38.7
3.5	2.0	37.0

Bleached sulfite. $Al_2(SO_4)_3 \cdot 18H_2O$ catalyst.

TREATMENT OF FABRIC——Rayon fabric was impregnated with an aqueous solution of the product under evaluation and of catalyst. The wet pickup was adjusted to 100% by variation in pressure on padding rolls. The wet fabric, premarked with the Sanforized test marker, was stretched on a pin frame to its original dimensions. The fabric was dried at 80-95°C and cured at 157°C for five minutes.

Cotton fabrics were treated as above except that a temperature of 150°C was used for curing.

ESTIMATION OF COMBINED FORMALDEHYDE AND DIETHYLENE GLYCOL ON FABRIC——

Method: Ten grams of fabric were weighed on the analytical balance, cut up into small bits and placed in a 1000-ml flask with 150 ml of 20% H_2SO_4 (analytical quality) and some boiling stones. The mixture was boiled for one hour, water being added as necessary and the distillate collected in 100 ml of distilled water. Then three drops of rosolic acid indicator were added to the condensate and neutralized with a 0.35 *N* NaOH solution to a red color. Formaldehyde was determined by addition of 25 ml of 2*N* sodium sulfite and titration of liberated alkali in the usual manner.

Fabric was reacted with the diethylene glycol poly(formal), washed at 100°C, and then hydrolyzed in presence of 30% sulfuric acid. The diethylene glycol was recovered from the neutralized mass in about 25-30% yield as an impure material. Confirmation of the identity was established by preparation of the 3, 5-dinitrobenzoate. The literature *(12)* gives 149° C as the melting point of the derivative of diethylene glycol. The 3, 5-dinitrobenzoate prepared from the hydrolysate melted at 148-149°C and did not depress the mp of a known sample of diethylene glycol dinitrobenzoate.

FIBER EXPANSION——Bright carpet staple (15-denier, three-inch) was teased apart, placed under a microscope and the diameters of at least 25 random fibers were measured and averaged. A drop of water was then placed under the cover glass and after five minutes the diameter again measured as above. The percentage of diameter expansion was calculated as:

$$\frac{\text{Average wet diameter}}{\text{Average dry diameter}} \times 100$$

In the case of a fabric, fibers were teased apart and the same procedure used.

Confirmation of this procedure was found by the use of the fiber cross section. Since the first procedure was simpler, albeit more approximate, most measurements were made by use of the simpler procedure.

DISCUSSION

In order to produce formal reaction products of cellulose, acidic catalysts are required. Study of the chemistry of the reactant used indicated several possibilities of the mode of reaction: 1) some fragmentation of the poly(formal) chain may take place, and 2) alcohol interchange may occur.

Crosslinks may be represented by a distribution among

$$Z\text{-}O\text{-}CH_2\text{-}O\text{-}Z \text{ and}$$
$$Z\text{-}O\text{-}CH_2\text{-}(O\text{-}CH_2\text{-}CH_2\text{-}O\text{-}CH_2\text{-}CH_2\text{-}O\text{-}CH_2\text{-})_n\ O\text{-}Z$$

where n may be 0, 1, 2, 3, etc and Z = cellulose chains.

Such a series of links may impart interesting properties to the fabric aside from those expected of a methylene cross link. Fabric crosslinked with poly(formal) does show a soft handle and better abrasion resistance than one would expect from a methylene-crosslinked cellulose.

Strong evidence for transacetalization is the fact that no formaldehyde

odor was present in drying or curing ranges, even on commercial scale, and it is believed that this reaction predominates. Recovery of bound diethylene glycol is evidence of some transacetalization. The results in Table V, indicating add-on greater than mere formaldehyde addition, points to this possibility.

Formaldehyde binding of viscose was reported by Woo, Dusenbury and Dillon (*24*) at temperatures lower than those used in this work. It is shown in Table X that formaldehyde binding efficiencies by the use of the poly(formal) are higher than those obtained by use of formaldehyde. This too is believed to support the transacetalization hypothesis.

It should be noted that, although the amount of formaldehyde bound in the fabric increased with increased application, virtually no difference in dimensional control existed (Table IV). This may be due to the fact that a minimum number of crosslinks reduce the swelling properties. The excess of formaldehyde may result from longer poly(formal) chains containing a greater proportion of formaldehyde than simpler links.

Different acidic catalysts may have different effects on the two reactions: 1) cross-linking, and 2) hydrolysis of the original acetal links in cellulose. In textile fabrics, the latter is indicated by a lowering of tensile strength and the former by reduction in swelling of the fiber. Addition of crosslinks to a polymer which is as crosslinked as natural cellulose will also reduce tensile strength. It is suggested that the catalyst may form an oxonium complex with the ether or formal oxygens in the poly(formal). This activated molecule may then attack the cellulose hydroxyls, forming the acetal crosslinkages.

TABLE X
Formaldehyde retained—poly (formal) and formaldehyde on viscose rayon

% of Applied HCHO retained Poly(formal) data	% HCHO applied	% of Applied HCHO retained from Woo et al (24)*
48.2	0.89	—
66.5	1.1	—
—	1.25	16.0
51.5	2.5	26.0
50.5	3.8	—
—	5.0	28.0

*pH 2.0, baking temp 130°C.

SUMMARY

The reaction of formaldehyde with cellulose has been known for over half a century. Both theoretical and spasmodic commercial interest has continued in recent years. It has been found that acetals in presence of acidic catalysts interact with cellulose as cotton and regenerated cellulose to yield products containing firmly bound formaldehyde. It is suggested that these reactions involve alcohol interchange with cellulose hydroxyls.

It is shown that simple acetals are not as efficient as linear polymeric formals in modifying properties of cellulosic materials. Polymetric diethylene glycol formals have been synthesized and applied in this study. Catalysts have been found which will effectively cause interaction without undue tensile losses in fabric. It has been shown that both the glycol and formaldehyde portions have been retained in the fabric after such treatment indicating that a transacetalization probably occurs. The poly(formal) treatment has also been shown to reduce swelling of viscose filament in water, thus affecting other fabric properties, such as shrinkage, dye receptivity and other physical properties. The portion of poly(formal) chain which is part of the crosslink also imparts distinct properties to fabric treated in this manner.

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General Calendar

AMERICAN ASSOCIATION FOR TEXTILE TECHNOLOGY
Mar 4, Apr 1 (Della Robbia Room, Hotel Vanderbilt, New York, NY)

AMERICAN COTTON MANUFACTURERS INSTITUTE
Mar 19-21 (Annual Convention — Palm Beach Biltmore Hotel, Palm Beach, Fla)
April 15-16 (ACMI Cotton Fiber Testing Lab Open House, The Clemson House, Clemson, SC

AMERICAN OIL CHEMISTS SOCIETY
April 20-22, 1959 (Roosevelt Hotel, New Orleans, La; Sept 28-30, 1959 (Statler Hotel, Los Angeles, Calif)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, TEXTILE ENGINEERING DIVISION
March 12-13 (Annual Spring Meeting, Clemson House, Clemson, SC)

AMERICAN TEXTILE MACHINERY ASSOCIATION
May 23-27, 1960 (American Textile Machinery Exhibition, Auditorium, Atlantic City, NJ)

CANADIAN ASSOCIATION OF TEXTILE COLOURISTS AND CHEMISTS (QUEBEC SECTION)
Mar 21, Apr 18 (McGill Univ, Montreal, Que); June 20 (Annual Golf Tournament)

COMMERCIAL CHEMICAL DEVELOPMENT ASSOCIATION
Mar 4-5 (Annual New York Meeting, Statler Hilton Hotel)

DRUG, CHEMICAL AND ALLIED TRADES SECTION, NY BOARD OF TRADE
Sept 17-20 (69th Annual Meeting, Sagamore Hotel, Bolton Landing, Lake George, NY

INTER-SOCIETY COLOR COUNCIL
April 1 (28th Annual Meeting, Statler Hilton Hotel, New York, NY)

THE FIBER SOCIETY
April 29-30 (Fontana Village, NC)

KNITTING ARTS EXHIBITION
May 4-8 (Atlantic City Auditorium, Atlantic City, NJ)

MANUFACTURING CHEMISTS' ASSOCIATION
Mar 17-18 (Air and Water Pollution Abatement Conference, Netherlands Hilton Hotel, Cincinnati, O)

NATIONAL COTTON COUNCIL
Oct 7 (Chemical Finishing Conference, Mayflower Hotel, Washington, DC)

PURDUE INDUSTRIAL WASTE CONFERENCE
May 5-7 (Purdue Memorial Union Bldg, Purdue Univ, Lafayette, Ind)

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES
Mar 11, April 14, June 9, Sept 15, Oct 13, Nov 4 (Luncheon meetings at the Hotel Roosevelt, New York, NY); May 11-13 (Spring Outing—The Cavalier, Virginia Beach, Va); Dec 2 (Annual meeting and dinner—Hotel Roosevelt, New York, NY)

TEXTILE SUBCOMMITTEE, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
April 2-3 (1959 Conference on "Electrical Applications in the Textile Industry," Heart of Atlanta Motel, Atlanta, Ga)

Proceedings of the

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February 23, 1959

Metropolitan Section———

QUANTITATIVE MEASUREMENT OF FABRIC APPEARANCE—PRACTICAL EVALUATION OF WASH AND WEAR CHARACTERISTICS*

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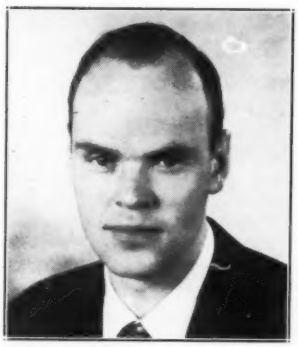

The principles governing the evaluation of the "wash and wear" characteristic, appearance, are discussed. The development of and technical basis for the evaluation method upon which the recently accepted AATCC Tentative Test Procedure 88-1958 is based are presented.

A critical analysis of this evaluation technique shows its series of pictorial standards to be responsible for the only major disadvantages of the method. Elimination of these disadvantages without violation of the test principles, through the use of three-dimensional patterns is proposed. A practical series of three-dimensional patterns is introduced and described.

INTRODUCTION

THE greatest single deterrent to the over-all development of "wash and wear" (abbreviated to W & W hereafter) in the last three years has been the lack of a good, widely accepted procedure for the quantitative measurement of W & W. The recent publication by the AATCC of such an evaluation procedure (Tentative Test Method 88-1958) *(1)*, in filling this need, provides a common ground where standards can be set, buyer and seller can measure value, and scientific developments can be advanced and compared—all to the benefit of industry and consumer alike.

W & W in all its practical aspects is an extremely complex property; even as an ideal it is a concept which defies exact definition. Its practical measurement must be subjective, which further complicates its evaluation. In view of this complexity, it is a remarkable testimony to the overwhelming importance of W & W that the development of the first officially accepted means of evaluation required only three years from the time its need was recognized.

The creation of an evaluation technique does not alone render a property less complex, however. It may in fact have the opposite effect, as it provides a means for expansion of knowledge. For this and other compelling reasons, it is highly desirable that the scientific principles governing W & W and its evaluation, as they are presently known, be described. In this manner the value and use of the present method will be enhanced by improved understanding, and a basis provided for the further development of its technology. Accordingly, the purpose of this paper is to discuss the present technology of W & W evaluation, to describe the scientific principles upon which the present procedure is based, and to analyze this procedure critically. It is a further object to introduce a radically improved technique based on practical utilization of the basic principles, which eliminates flaws introduced in the development of the present test.

PRINCIPLES OF W & W EVALUATION

The concept of W & W is best defined in ideal terms. One such definition is that the ideal W & W fabric or garment is one that, after repeated washing and drying, presents, with no further care, the ultimate in appearance. The most important word in this, and the many other definitions which have been advanced, is "appearance." This is the property that W & W truly implies, the performance desired by the consumer, the criterion for judgment of W & W. Published studies and evaluation methods dealing with W & W *(2-6, 11)* have all relied on some technique for measuring appearance. The key to the quantitative measurement of W & W is therefore the quantitative measurement of appearance, used in conjunction with some standardized procedure for washing and drying the fabric.

Appearance is not just a physical property—it is a concept formed by the mind, an impression dependent as much upon a person's experience, opinions, and mental disposition as it is upon the image received upon the retina of the eye. In a word, appearance is subjective. It must therefore be measured by one of two techniques, either subjectively, or by an objective technique which correlates well with subjective evaluation. An analysis of the factors known to influence W & W is necessary to determine which one of these two techniques is most applicable.

The major influences on W & W fall into two categories: 1) those that influence the physical configuration of the fabric (eg, wrinkle recovery,

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dimensional stability, fabric construction), and 2) those that influence psychologically what the observer sees (eg, color, pattern, contrast).

Through proper control of variables, correlations of W & W with physical properties capable of objective measurement, such as wrinkle recovery, have been determined *(2)*. For example, W & W is directly related to the wrinkle recovery of white cotton fabric treated with a variety of resins, so that, with white cotton fabric in a normal construction, wrinkle recovery may be used as an objective method for the evaluation of W & W. However, this cannot be extended to include other fabrics, such as rayon or nylon, because their wet to dry wrinkle recovery relationships differ from that of cotton, and dimensional stability also has an effect, thus yielding entirely different W & W—wrinkle recovery relationships.

Still considering plain white fabrics, it is possible that a more complex but still objective technique for measurement of fabric surface, applicable to all fabric and fiber types, could be created. A device has been described by Hebeler and Kolb *(7)*, which quantitatively measures the irregularity of a surface, and could conceivably be adapted to this use. Weighting factors for the various types of deformations (creases, wrinkles, puckers, ripples) might be developed, again by comparison with subjective ratings, and applied to the analytical results to provide a numerical value for appearance.

Even this complex technique, if developed, could not be widely applied, for it would not measure any of the psychological factors which have influence on W & W. These factors appear incapable of being correlated with any objective property, being dependent upon the esthetic nuances of designs, colors and contrasts, as well as the masking of mechanical configurations. In view of this, it was concluded early in the work that a widely acceptable method for the quantitative measurement of W & W must be subjective.

This is not a rare or even unusual situation. There are many AATCC, ASTM, and Federal Specification Tests based upon subjective techniques. The general basis for these methods is usually a series of standards representing varying degrees of the important property, against which test samples may be compared. The creation of the standards, and their relationship to a quantitative factor which has practical meaning to those concerned with the property, is the foundation of these subjective methods.

TABLE I

Wrinkle recovery and wash-and-wear ranking of the W & W standard series

Code No.	DMEU solids deposited (%)	Wrinkle recovery Total W + F (°)	W & W ranking (1 best)	W & W standard class # assigned
0*	11.0	287	1.0	1
1	11.0	287	2.2	2
2	8.2	282	2.9	3
3	6.0	268	3.9	4
4	4.5	253	5.0	5
5	3.4	233	6.0	6
6	2.6	218	7.2	7
7	1.9	196	8.4	**
8	1.4	186	8.5	8
9	1.0	166	9.8	**
10	0	128	11.0	9

*Sample 0 identical to Sample 1, but not washed before W & W ranking.
**Not included in Standards.

ORIGIN AND DEVELOPMENT OF THE PRESENT EVALUATION STANDARDS

When it was first established that a subjective method was required, the immediate problem became the creation of a series of appearance standards upon which the test could be based. It was here that the limited correlation previously discussed, the direct relationship of W & W and wrinkle recovery on plain white cotton fabric, proved of great value. Here was a practical means of varying the appearance of fabrics after washing over a wide range, in a controlled, quantitative manner, as determined by an *objective* technique, by the application of varying amounts of thermosetting resin.

Concurrent investigation in these laboratories of the relationship of the physical properties of resin-treated cotton to the amount of resin applied, established that, over a wide range of resin solids, fabric wrinkle recovery was directly related to the logarithm of resin solids applied *(8)*. Combination of these relationships suggested that a series of cotton fabrics varying in equal increments of appearance (W & W) could be created through application of logarithmic increments of resin to samples of a standard construction, white, cotton fabric. Investigation and utilization of these principles, as described below, resulted in the creation of a series of appearance standards.

Formulations of 1.25, 1.70, 2.25, 3.0, 4.0, 5.25, 7.0, 9.4, and 12.5% solids of dimethylol cyclic ethylene urea (DMEU) were prepared with a 35% organic amine hydrochloride catalyst product, containing either 0.6% catalyst on formulation or 15% on resin solids, whichever was greater. Samples of a white, pure finish, 84 x 76 cotton print cloth were wet out in these formulations, padded to approximately 80% wet pick-up, framed to original dimensions, dried three minutes at 212°F and cured three minutes at 310°F.

The wrinkle recovery of these fabrics was determined on the Monsanto Wrinkle Recovery Tester, by AATCC Test Method 66-53 *(9)*, using a five-minute recovery period. The W & W ranking of the fabrics was determined as follows:

> Twelve-inch pinked squares of each treated fabric and a water control were washed in a cylindrical reversing wash-wheel-type machine *(10)* with normal load and detergent, at 160°F for 20 minutes, and then given two five-minute rinses at 160°F and 100°F respectively. The samples were removed immediately, hung by two corners, warp direction vertical, to air dry for two hours, and then laid on a flat surface to condition at 70°F and 65% RH for 22 hours prior to evaluation. Under conditions of diffuse, oblique lighting, these samples and an unwashed sample of the 12.5% treatment, all randomly coded to eliminate bias, were rated in the order of their appearance (1 best).

Figure 1 presents the data obtained as a function of the logarithm of resin solids (abscissa), for both wrinkle recovery (squares, left ordinate) and W & W (triangles, right ordinate). The direct linear relationship of each property with the logarithm of resin solids is identical with the other, establishing the validity of the principles involved, and indicating complete control of the other variables which influence W & W.

This data is recorded in Table I together with the nomenclature of the standard series selected from these fabrics, while Figure 2 presents graphically the relationship of these assigned numbers to wrinkle recovery and applied resin solids. It will be noted that standard 1 is an unwashed fabric, representing ideal appearance, and that two of the low solids treatments have been eliminated, to provide a series of nine patterns, the lowest of which represents the appearance of untreated fabric.

To accomplish the original goal of this work (the provision of a standard series of appearance patterns), these fabrics were preserved against change in configuration by the de-

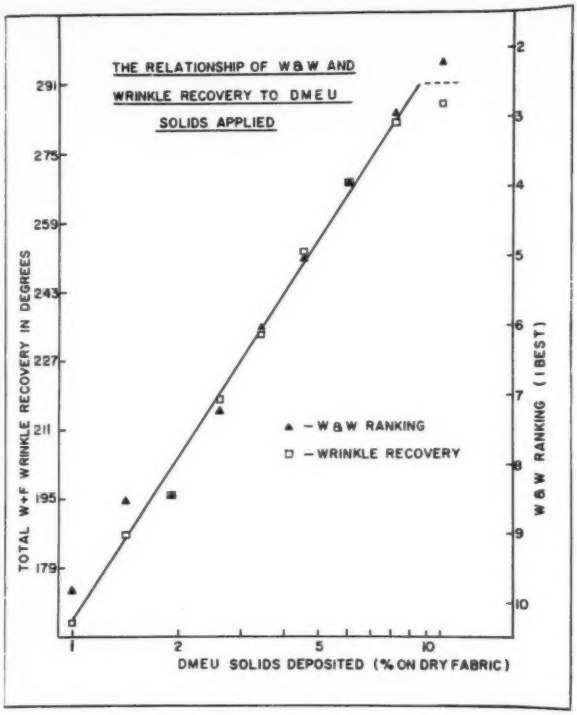
THE RELATIONSHIP OF W&W AND
WRINKLE RECOVERY TO DMEU
SOLIDS APPLIED
TOTAL W+F WRINKLE RECOVERY IN DEGREES
W & W RANKING (1 BEST)
▲ – W & W RANKING
□ – WRINKLE RECOVERY
DMEU SOLIDS DEPOSITED (% ON DRY FABRIC)

Figure 1

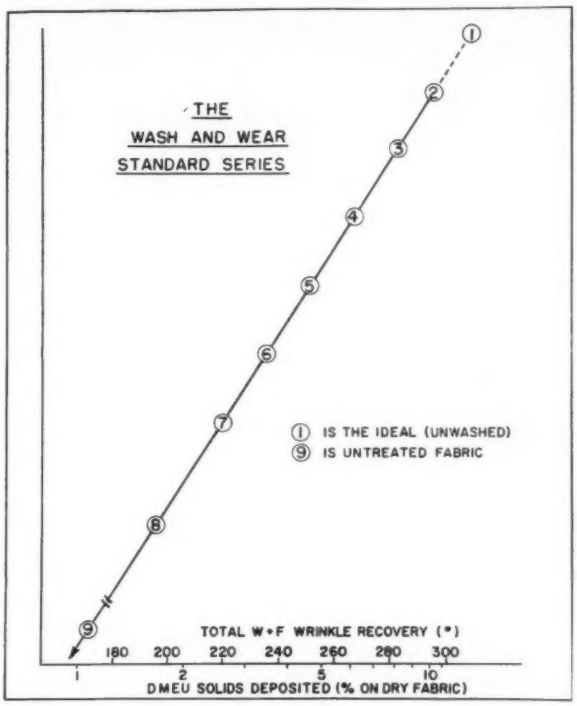

Figure 2

position of a thin layer of rigid plastic on the back side, and permanently mounted on boards which could be stored as shelves in a cabinet. Deposition of the plastic layer without fabric distortion was accomplished through the repeated application of a diffuse, low-pressure aerosol spray.

Detailed analysis of this fabric series yields valuable insights into the relative influence of the various fabric distortions (wrinkles, creases, ripples, puckers) on appearance. It yields a better understanding of the mechanisms by which the W & W performance of cotton (and by analogy, rayon and other fibers) is and may be improved, which is more complex than the correlation with wrinkle recovery would suggest. Such an analysis is outside the scope of this paper, however, so that we shall consider here only the practical aspects of this series as an evaluation tool.

Through the use of controlled washing and drying procedures and viewing conditions, it is possible to assign a quantitative value to the appearance (W & W) of any fabric, using this series.

Laboratory evaluation by this technique of a wide range of fabrics further established the validity of the test principle. Dissimilar fiber contents, fabric constructions and weaves, finishing treatments, whites, plain shades, and prints, were all consistently evaluated for W & W with gratifying precision and accuracy. Communication of these results in meaningful terms to others was not possible, however, as only one standard series existed, and the relationship of number to actual appearance could not be described without the series. It was therefore necessary to reproduce this standard series in some manner that would allow its widespread usage.

TABLE II
AATCC 88-1958 evaluation standards nomenclature

AATCC category	*Original lithograph number*	*Wrinkle recovery W + F, degrees*
5	2	287
4	3	282
3	5	253
2	6	233
1	8	186

Preparation of further sets by this technique was impractical for this purpose. Apart from the extreme amount of time and care the manufacture of each set would require, exact duplication of the random patterns would not be possible, and no two sets of standards would be the same.

The alternative was finally chosen of photographing these standards under lighting conditions similar to those used in the evaluation procedure, thereby obtaining pictures of the standards which could convey a concept of their appearance to others. Uniform reproduction of these pictures in large number was accomplished by a lithographic technique. These photographs of the series, together with a description of the evaluation technique, became available *(11)* over two years ago.

The AATCC Committee on Wash and Wear selected the lithographic series of standards for investigation as an evaluation technique. Thorough study of the technique, and modifications of same, over a comprehensive range of fabrics in laboratories of the textile, retail, and chemical industries, was carried out. It was found desirable to reduce the number of increments and broaden the range of each standard, in order to meet the practical requirements of an industrial test, this being done by selection of five of the nine photographs, as indicated in Table II. The evaluation technique of AATCC Tentative Test Method 88-1958 was then successfully developed by the Committee on the basis of these five standards, numbered according to the established AATCC system for subjective procedures.

CRITICAL ANALYSIS OF THE EVALUATION STANDARDS

There is no doubt that these efforts, on the part of a great number of

people associated with the AATCC and the textile industry, have created, in a remarkably short time, an adequate test method, where none had previously existed. It has been used successfully on a comprehensive variety of fabrics in a large number of laboratories over considerable periods of time. At the same time, experience has indicated certain areas where improvement is desirable. Most of the possible improvements appear to lie in the actual evaluation method and standards.

The most serious fault is the use of a two-dimensional lithograph as a standard against which to compare a test specimen in three dimensions. Even though the appearance concepts obtained from the pictures have been proven reliable and reproducible in terms of test results, there is good reason to believe that lack of a directly comparable standard in the same dimensions as the test specimen is responsible for less accuracy, poorer precision, and greater difficulty in test operation, than is inherent in the procedure.

A second flaw is the composite result of the various techniques used to photograph the original series and reproduce the pictures, and the selection of five categories from a series based on nine. Due to the variables of reproduction, it is likely that the series of nine lithographs did not represent exactly the equal increments of W & W of the original series, which in turn probably influenced the choice of the five selected for the evaluation procedure. The result has been that there is no longer any objective measure of the absolute level of W & W which could be applied to the series, or the spacing of the standards by equal increments.

Both of these faults have their origin in the photographic reproduction of the original three-dimensional series, which was necessary to the practical and successful utilization of the test principles by the industry. Significant improvement in this area required that an improved means of preparing the standards be developed.

PREPARATION OF STANDARDS IN THREE DIMENSIONS

As three-dimensional standards are the ideal for this subjective procedure, various means were investigated for the preparation and identical reproduction of a set of three-dimensional standards. A method was finally evolved which would accomplish this end, as outlined below.

TABLE III
Three-dimensional standards nomenclature

Standard number	*Average rating original 3-D series (1 best, 9 worst)*	*Wrinkle recovery W + F, degrees*
5	1.7	290
4	2.9	280
3	4.2	260
2	5.5	240
1	7.0	220

Utilizing the principles governing the creation of the first set of standards, and the results of industrial and AATCC experience with them, a set of five fabrics was prepared by application of logarithmic increments of dimethylol cyclic ethylene urea to white, pure finish, 84 x 76 cotton print cloth, under the exact application conditions used to prepare the previous set. These fabrics were then washed according to test procedure 4a of Tentative Test Method 88-1958, using a 20-minute (rather than 10) wash cycle.

The resultant fabrics were then given repeated light sprayings of an aerosol plastic spray on the back of the samples, which, without wetting or distorting the fabric in any manner, gradually built up a very thin water-resistant plastic layer, which imparted slight rigidity to the specimen.

Repeated brushings of a very thin slurry of plaster of paris, with adequate drying, served further to reenforce the fabric pattern. Finally, sufficient rigidity was obtained to allow casting of a solid plaster back directly on the built-up plaster layer, thus producing a rigid mold with a fabric face in its original state of configuration.

A manufacturer of precision molds was then able to prepare, without distortion and in fine detail, metal molds in the reverse of these patterns. Subsequent vacuum forming of plastic sheet, under conditions suitable for excellent detail reproduction, produced a rigid white plastic sheet with the exact form and appearance of the original fabric specimen, every sheet from the same mold being an exact duplicate of this pattern.

In order to provide a quantitative orientation of this new set of standards with the previous ones, and insure against possible distortions during processing, a set of these five plastic three-dimensional standards was evaluated against the original series of nine fabric three-dimensional standards. These ratings and the approximate wrinkle recovery values of this series are recorded in Table III.

Evaluation of the appearance of various fabrics by the procedures of Tentative Test Method 88-1958, using this new series of evaluation standards, was carried out. The results indicated a marked improvement over the present lithographed standards, and practical achievement of the ideal subjective method where standards and test specimens are in the same form and dimension.

These standards (*12*), which have a firm origin in both the scientific and practical principles of W & W evaluation, therefore offer an improved technology for the support of the entire W & W development.

SUMMARY

The quantitative evaluation of the primary W & W characteristic, appearance, is of necessity subjective, and therefore dependent upon a standard set of appearance patterns. The recently published AATCC Tentative Test Method 88-1958 utilizes a set of photographic appearance standards, based on established scientific principles. Reproduction and adaptation of these standards into a practical industrial test required a compromise of these principles which resulted in certain disadvantages associated with the standards. A new and superior set of standards has resulted from a better practical utilization of the scientific principles, through the development and use of a technique for the reproduction of three-dimensional standards.

ACKNOWLEDGMENT

The author is sincerely grateful to the many people who, over the past two years, have contributed immeasurably through suggestion and thoughtful criticism to the development of the concepts and procedures discussed here.

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37th National Convention———

EXPANDING THE MARKET FOR NONWOVEN FABRICS*

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The rapid growth of the nonwoven fabric industry has been based upon careful product design to meet specific performance characteristics—future expansion will be similarly achieved. Considerable additional progress has been made in taking advantage of the versatility available in bonded constructions to achieve manufacturing and assembly economies in the industrial field. Deeper penetration of the apparel market has been realized with washable and drycleanable contructions possessing improved hand and drape.

The importance of the following considerations is discussed with specific examples relating to typical industrial, household, or apparel applications:

Selection of fiber or fiber blend.
Formation of the web.
Selection and compounding of binder.
Method of applying binder.
Drying and curing of binder.
Finishing treatments.
Evaluation and product performance.

Heat-sealable nonwoven fabrics and waddings are establishing new product design concepts and attendant assembly economies. Much of the growth potential for nonwovens will be derived from the utilization of this characteristic, which can be built into bonded constructions.

INTRODUCTION

IT has become quite popular in the past few years to speak in glowing terms of the tremendous potential market for nonwoven fabrics. Frequent reference is made to an expected growth rate equivalent to doubling output every three years for a period reaching well into the 1960's or 70's. A projected growth pattern approximating a 25% increase in annual output and sales over 10 or 15 years is bound to be attractive to all of us, including present and potential manufacturers of nonwovens, fiber suppliers, equipment and machinery sources, binder suppliers, and other related interests. Such growth will not *just happen,* just as the growth to date has not been accidental. The success of nonwoven fabrics has been and will continue to be based upon careful, well-planned constructions designed for specific applications in markets which reflect needs that have been carefully analyzed. Here, if anywhere, lies the secret of the ever-increasing success and growing market for nonwoven materials. Versatility of product characteristics, such as weight, density, hand, appearance, physical, chemical, electrical and thermal properties, properly applied and utilized by an alert and aggressive management, development production and sales combination represents the key to this growth market. The gathering and continuing application of this knowledge involves trained personnel, a considerable capital outlay, and patience and tenacity stemming from confidence in the ability to fulfill the need and requirements of a well-analyzed market.

Versatility is best illustrated in the manufacture of bonded nonwoven fabrics. The bonded system of manufacture is the most widely used and gives the producer the opportunity of economically turning out constructions of widely divergent service characteristics for specific applications of customers. Readily controlled variables include fiber type, blend, denier, and length; fiber orientation; web weight and density; binder type, compounding, application method, and location; drying, fusing, or curing conditions; finishing operations of all types including scouring, dyeing, printing, calendering, embossing, etc. These are topics which have been well covered in recent literature. (*1, 2*).

To date no producer has seriously attempted to blanket all methods. It has been possible to characterize producers by their bonding methods, which include saturation, spray, pattern, or dry powder techniques. Because of the commercialization of standardized acceptable saturation and spray equipment, these techniques are the most widely used and have played a prominent role in past successes. These same techniques are evident in some of the comparatively recent developments which will in all probability contribute heavily to the anticipated growth of the industry.

DISCUSSION

WALL COVERINGS———Earlier this year a representative of the National Cotton Council of America presented its analysis of the market for wall coverings, which indicated a billion-yard annual potential. Others had already been studying the market for wall coverings and had determined that an economically feasible nonwoven construction could be developed with processing and performance properties that would yield a unique, superior and marketable product. In this case, the end product visualized was a coated nonwoven construction comprised of a tear-resistant nonwoven substrate, which could be coated readily, by conventional means, with a polyvinyl chloride plastic. Close cooperation between a producer of nonwovens and a manufacturer of wall coverings resulted in ultimate market introduction only after two years of persistent and calculated trial and error. The recognition, definition, and solution to a multitude of problems accompanied this development. Typical questions involved maximum binding efficiency, adhesion of the vinyl coating, compatibility, maximum physical properties, and uniformity of gauge. Assistance on both points is readily available from fiber, equipment, and binder suppliers. There is room in the expanding nonwoven-fabrics market only for suppliers and producers who are intent on helping shape and maintain a stable industry based upon carefully engineered constructions and their well-planned application. We have a duty to be vigilant and insistent that nonwoven materials be intelligently utilized, applied, and promoted. The wall-covering construction that I have mentioned is an example of how the continued increase in market potential for nonwovens will be accomplished.

NOVEL INTERLINER ——— Another excellent example of planning for market expansion lies in a highly promising application for the apparel trade. Again, early this year, a leading supplier of garment linings un-

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veiled a converted product designed around the specialized properties that could readily be built into a nonwoven. Quilting materials, as such, are ages old—but nonwoven techniques, clever conception, and careful development effort has resulted in the availability to cutters of a line of specially converted insulating-type interliners which are already making their impact upon the design and manufacture of outerwear, sleeping bags, etc. In this particular case, a lofty and preferably randomly formed web is spray bonded so as to retain a high degree of resilience and thermal - insulation characteristics. The resultant construction is bonded either to conventional lining fabrics or to outer fabrics to yield a unique laminated product. This laminated construction makes possible the design and assembly of garments, comforters, sleeping bags, etc, without the necessity of depending upon costly all-over stitching to insure construction stability and prevent shifting and lumping of the fibrous interliner. The simultaneous handling of interliner and either lining or outer fabric as a single unit, simplifies cutting operations, reduces waste, and insures neater appearance.

Here again we can visualize the care and thought involved in designing constructions to meet end-use requirements. Fiber selection plays an especially important role in spray-bonded, low-density assemblies because the finished construction directly reflects the resilience and absorptive characteristics of the fiber blend. The binder should not mask the basic physical properties of the fibers and should be selected and compounded, if necessary, to insure such desirable characteristics as washability, drycleanability, softness of hand, and excellence of drape. Lamination must not interfere with hand and drape, and at the same time must not change the appearance of the lining or outer fabric. Aging and service tests should be used to make certain that the construction will not stiffen or discolor.

Ample proof of the growing potential for this converted application of a nonwoven fabric was available at the 1958 Sports Outerwear Suppliers' Exhibit conducted under the auspices of the National Outerwear and Sportswear Association in New York.

FURNITURE CONSTRUCTION——Another highly promising application was introduced at the recent Supply, Equipment, and Fabric Fair conducted by the National Association of Furniture Manufacturers in Chicago. This product consists of a highly resilient spray-bonded pad, which was designed for use as an overlay to be used in conjunction with foam-rubber cushion cores. The presence of the pad insures a tight construction whether the cushion is under compression or in the act of being compressed. This system, which answers a chronic complaint concerning the performance of foam rubber in furniture construction, is being hailed by designers and manufacturers alike. With the spray-bonded overlay, the manufacturer can retain all of the desirable attributes of foam rubber construction and performance. The nonwoven pad was developed through the direct cooperative efforts of a leading supplier of man-made fibers and a manufacturer intimately associated with the furniture-manufacturing trade. Success stemmed from the availability of a 25-denier hydrophobic fiber, which contributed the desirable resilience, permanence, and density characteristics. By careful selection of binder and compounding ingredients, these desirable properties are retained and dimensional stability is achieved, despite the anticipated rigors of exposure to industrious housekeepers and their promiscuous use of soaps, detergents, hot water and drycleaning solvents. Here then is a case where the contributions and collective knowledge represented by the producer's development, manufacturing, and market personnel was supplemented by the efforts of fiber producer and binder supplier. The result is a new product, representing a new horizon for nonwoven fabrics with benefits both to the consumer and to the trade.

OTHER POSSIBILITIES——Other highly promising areas of significant potential involving the introduction of nonwoven fabrics include lightly spray-bonded constructions for quiltings and pillow filling and saturation-bonded, high-tear strength assemblies for use as backings in the manufacture of tufted throw rugs. Field evaluation of such products is well advanced. Nonwoven products are already well represented in the field of filtration media and are well adapted to being tailored to meet the precise requirements of specialty industrial filtration problems.

Over the years the automotive industry has pioneered many innovations in manufacturing techniques through a willingness to design around unique raw materials properties or characteristics. An excellent illustration is furnished by the changes which have occurred in interior trim in the past few years. Door panels, and more recently the head lining in certain models, have moved from fragile stitched and stapled assemblies with relatively high construction and installation costs to a durable, attractive, automated assembly that results in lower first cost, lower installation cost, and reduced maintenance. This change was achieved by taking advantage of the heat-sealing characteristics of certain polyvinylchloride latices and resins. A typical construction incorporates a backing stock coated with a suitable vinyl plastic latex, such as Geon Latex 576, overlaid with a spray-bonded, lofty, nonwoven "plumper" fabric that incorporates the same plastic latex. This is followed by the application of a vinyl-coated fabric or treated paper as the visible wearing surface. The entire precut assembly is placed in a hot bar or dielectric sealing press where it is heat sealed and deep embossed rapidly and simultaneously.

There has been little exploitation of this technique outside of the automotive industry to date. The potential impact of these methods upon design and manufacturing techniques in the furniture, luggage, and building fields will be interesting to watch. The joint AATCC-ASTM committee on nonwoven materials has recognized the growing importance of heat sealability and as a result has established a subcommittee on the subject. Through its efforts, the experience of the automotive industry, and the studies conducted by suppliers such as my own company, the property of heat sealability is likely to achieve significant stature in the eyes of all industry—possibly even in the apparel cutting trade.

SOURCES OF GUIDANCE——Reference has already been made to the need for careful consideration and study of the various fibers, blends, binders, binder-compounding techniques, application methods, etc. It is only in rare instances that sufficient knowledge concerning these broad areas is concentrated in the hands of the appropriate development man or group within a single organization. The necessary information is, however, readily available from responsible fiber sources and binder suppliers. These commercial sources are geared to provide detailed information in their respective product areas, which can be sifted, analyzed, and applied by the producers and consumers of nonwovens in arriv-

(*concluded on page 49*)

37th National Convention—

THE DYEING OF WOOL PRETREATED TO PRODUCE CONTRAST EFFECTS*

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A process has been devised whereby two samples of wool, one treated and one untreated, can be dyed together in one dyebath containing two selected dyestuffs, in such a manner that the two samples are dyed different colors.

During the dyeing, one of the two dyestuffs in the bath dyes both the treated and untreated samples of wool; the second dyestuff is absorbed preferentially by the untreated sample. The pretreating agent leaves the wool and enters the dyebath; this, however, is a reversible process and some of the agent in the bath then returns to the wool. It has been found possible to correlate the uptake of dyestuffs from the dyebath with the removal of the pretreating agent from the wool.

The pretreatment consists only of dyeing the wool in an acid bath using, in place of a dyestuff, a colorless compound such as the condensation product obtained from a naphthalene sulfonic acid and formaldehyde.

INTRODUCTION

DURING the past few years a considerable amount of interest has been shown in dyeing processes for wool which result in contrasting color effects. In October of 1955 an article appeared (*1*) announcing a process whereby wool blankets could be dyed two different shades in one bath. An appraisal of the processes available for resist dyeing of wool was published in the early part of 1956 (*2*), and in the latter part of the same year an article entitled "Cross-dyeing All-Wool Fabrics Containing Chlorinated Wool" (*3*) appeared.

Our interest in the problem stemmed from a suggestion by a woolen mill that we develop a process by which the nubs and the body of nubbed wool fabric could be dyed two different colors in the same dyebath.

The initial plan of attack was to take advantage of the fact that different dyestuffs require different pH's for their successful application to wool (*4*), and attempts were made to vary the pH of the wool to be dyed by pretreating it with various acids.

Work along these lines was unsuccessful until a resist agent—a condensation product of formaldehyde and a napthalene sulfonic acid (*5*)—was incorporated in the pretreating bath. By pretreating two samples of wool, both with the resist agent but with different acids in the bath, we obtained reasonably good results when the two pretreated samples were dyed together in a bath containing two selected dyes at a controlled pH in the presence of Glauber's salt.

It was soon realized that the same contrast results could be obtained by pretreating only one sample of wool and dyeing it, together with an untreated sample, in a bath under controlled conditions. This process was investigated in considerable detail.

The method of pretreatment was investigated first. Various agents were applied with the aid of a variety of acids under controlled conditions of pH, time and temperature. After establishing what appeared to be the optimum pretreatment for maximum contrast using one pair of dyes, we investigated the applicability of this treatment to a large variety of dye combinations. During this phase of the work, dyeings were made with one, two or three dyestuffs in the dyebath.

The effect of the variables which normally are readily controllable in any dyeing operation—dyestuffs used, ratio of dyes, dyebath ratio, amount of salt, etc—were investigated, and finally the light- and washfastness of some of these dyeings were determined.

It was learned that the process as developed to this point was similar to the Maifoss Process (*6*) The Maifoss group, however, had investigated the procedure much more thoroughly and used many different types of pretreating agents. In the Maifoss process, the wool, dyestuffs and pretreating agent are all added together in one bath, thereby obtaining "ingrain" (colored and white) or "melange" (two different colors) effects in the fibers being dyed.

Our attention was next turned to a study of the behavior of the resist agent and the two dyestuffs during the actual contrast-effect dyeing. This phase of the work was effected by removing samples from a dyebath at frequent intervals during dyeing, and examining them spectrophotometrically. The results obtained, when combined with spectrophotometric data on each component from solutions of known concentrations, yielded estimates of the concentrations of each component at each stage of the dyeing. In the initial investigations of these phenomena, both of the samples in the dyebath were pretreated.

This work was then extended by determining the concentrations of each component in the dyebath (two dyes and the pretreating agent) as well as the amounts taken up by both fabrics during an actual dyeing. (In this work only one of the samples of wool was pretreated.) This was effected by removing small amounts of each of the wool samples (treated and untreated) and liquor from the dyebath at intervals during the dyeing. The dye was stripped from the fabrics and the solutions thus obtained, as well as the dyebath samples, were examined spectrophotometrically. The data were used to compute the concentrations of each of the components in the bath and on each fabric.

Complete details of all of this work are available as unpublished Master's Theses at the Georgia Institute of Technology (*7, 8, 9, 10*).

EXPERIMENTAL

THE PRETREATMENT ——— Three commercially available pretreating agents, all of the same type (*5*), were evaluated at various strengths when applied with different concentrations of various acids for different periods of time The acids used in these experiments were sulfuric, phosphoric, acetic, formic and carbolic (phenol).

*Presented by William Postman on October 30, 1958 during the 37th National Convention at the Conrad Hilton Hotel, Chicago, Ill

Samples of knitted wool fabric (1.0 gram, weighed without previous conditioning) were treated at the boil in 100:1[1] baths. The effect of each pretreatment was determined by dyeing one treated sample and one untreated sample (1.0 gram each) in a 100:1 bath containing three percent owf[2] of a dye similar to CI Acid Orange 1 and one percent owf of CI Acid Blue 45. The samples were put into the bath at room temperature; the bath was heated to the boil during 45 minutes; the samples were then removed, rinsed and dried.

As a result of this work, the following method is recommended for pretreatment of wool to be used in a contrast dyeing: Boil for 45 minutes in a 100:1 bath containing 10 ml of 85% phosphoric acid for each gram of wool being treated, and 30 to 40% owf of a condensation product of formaldehyde and a naphthalene sulfonic acid (eg, Synthratan ACA).

Once a satisfactory pretreating procedure had been established, the variables in the dyeing process were investigated.

THE DYEING——The study of the dyeing itself called for determining the effect of the following on the contrast obtainable: dyestuffs (several different combinations of dyes were used and the concentration of each was varied), time, temperature, pH, ratio of dyebath volume to weight of fibers being dyed, and salt.

The acid dyestuffs used were grouped according to the manufacturer's recommended method of application, ie, on the basis of the kind of acid, amount of acid or salt used to adjust the initial pH of the dyebath. This method of classification, and the dyestuffs used are given below.

Group 1 Dyes (Initial pH of the dyebath adjusted with 1 to 4% sulfuric acid, 66° Be):
- CI Acid Blue 45
- CI Acid Yellow 11
- CI Acid Red 34
- CI Acid Red 37
- CI Acid Orange 6
- CI Acid Blue 43
- CI Acid Yellow 3

Group 2 Dyes (Initial pH of dyebath adjusted with 2 to 8% acetic acid, 28%):
- CI Acid Red 18
- CI Acid Red 106

Group 3 Dyes (Initial dyebath pH adjusted with 1½ to 6% acetic acid, 28%):
- Fast Acid Yellow GS (similar to CI Acid Orange 1)
- CI Acid Yellow 44
- CI Acid Blue 102

Group 4 Dyes (Initial dyebath pH adjusted with 2 to 5% acetic acid, 28%):
- No dyes in this group were used

Group 5 Dyes (Initial dyebath pH adjusted with 2 to 5% ammonium acetate:
- CI Acid Black 26

The results of this work are summarized in the following recommended dyeing procedure: Dye a pretreated sample and an untreated sample in a 100:1 dyebath containing 3% owf of the dye with the higher group number and 1% owf of the dye with the lower group number at the boil for 30 minutes at a pH of 3.0 (adjusted with phosphoric acid).

This phase of the work was terminated with two dyeings conducted on a considerably larger scale in a Smith-Drum rotary dyeing machine. One-half pound of knitted wool cloth and one-half pound of wool blanket material were pretreated by the recommended method, using 30% Tamol N (a neutral sodium salt of a complex condensed aryl organic acid) as the resist agent. The pretreated knitted material was dyed with one-half pound of untreated knitted goods in a bath containing two dyes, one from Group 1 and one from Group 3, following the recommended dyeing method. The blanket material (one-half pound each of treated and untreated) was dyed by the recommended method in a bath containing one dye from Group 2 and one dye from Group 3. The results of both dyeings were quite satisfactory.

DETERMINATION OF CONCENTRATION OF DYEBATH COMPONENTS IN THE BATH AND ON THE FIBERS DURING AN ACTUAL CONTRAST-EFFECT DYEING ——In an attempt to remove water-soluble impurities which might interfere with the absorption curves, the wool before use in these experiments was boiled in an 80:1 bath of water, the pH of which had been adjusted (with diammonium phosphate or phosphoric acid) to that to be used in the subsequent dyeings.

In a typical experiment, woven woolen blanket material, prepared as above, was weighed and cut into pieces which would be readily distinguishable in the dyebath. One set of samples (untreated) consisted of one ten-gram piece and thirteen rectangular pieces each weighing 0.2 gram. The second set (pretreated with a resist agent—40% owf Synthratan ACA—by the recommended method given above), to be dyed in the same bath with the first, consisted of one ten-gram sample and thirteen square 0.2-gram pieces Both of the ten-gram samples remained in the dyebath throughout the dyeing: the smaller samples were removed during the course of the dyeing.

A dyebath containing 0.428 g/l (3% owf) of Fast Acid Yellow GS (similar to CI Acid Orange 1) and 0.143 g/l (1% owf) of CI Acid Red 18, adjusted to a pH of 3.0 with phosphoric acid and totaling 1769 ml in volume was prepared. The completed dyebath, containing the samples, was placed over a constant-intensity gas flame, and dyeing was carried out with the aid of mechanical stirring. Water lost by evaporation was replaced as the dyeing proceeded.

Ten milliliters of dyebath and one each of the 0.2-gram samples of treated and untreated fabric were removed at three-minute intervals, beginning six minutes after the fabric samples were placed in the bath. A total of thirteen sets of samples was taken. Times and temperatures of sampling are given in Table I.

TABLE I
Samples taken during dyeing

Sample no.	Dyebath temperature (°F)	Elapsed time (min) from initial entry of fabric into bath
1	87	6
2	100	9
3	118	12
4	136	15
5	150	18
6	161	21
7	169	24
8	180	27
9	190	30
10	boil	33
11	boil	36
12	boil	39
13	boil	42

Each of the fabric samples removed from the dyebath was treated in a Soxhlet extractor with 150 ml of a 10% aqueous pyridine solution until it showed no further traces of dye. The time of stripping varied from two to ten hours, depending upon the depth of shade to which the sample had been dyed. Each solution obtained in this manner was adjusted to a pH of 6.0 with phosphoric acid, after a few drops of a nonionic surface-active agent were added to prevent turbidity, then diluted to the desired volume.

The optical density of each solution was determined at 320, 410, and 500 millimicrons with a Beckman

[1]All ratios given are weight of bath to weight of fabric.
[2]Based on weight of fabric.

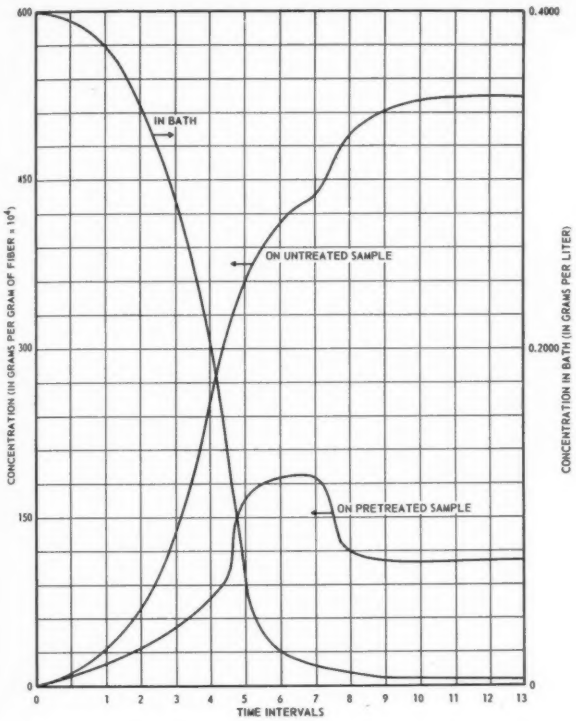

Figure 1
The yellow dye

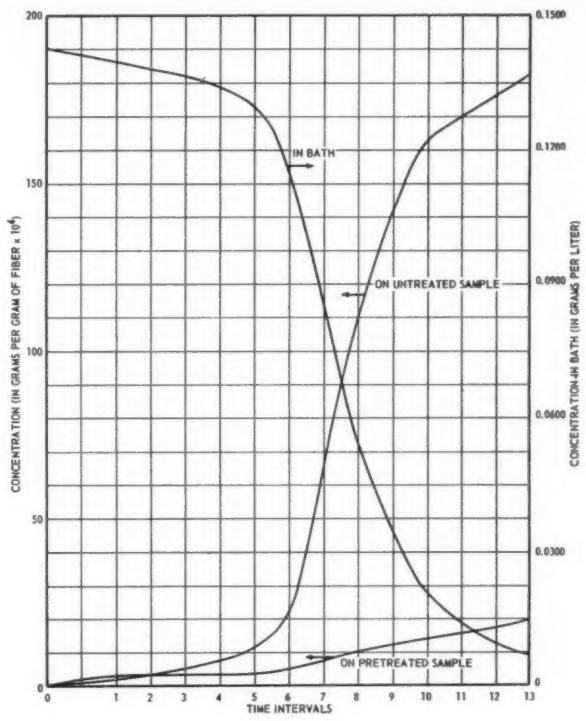

Figure 2
The red dye

Model DU spectrophotometer equipped with a photomultiplier attachment.

Absorption curves for each of the dyebath components had previously been obtained in solutions of the desired pH, over the wave-length range 320 to 520 millimicrons. In each case the dyestuffs and the pretreating agent were used as received from the manufacturer. All concentrations were based on the assumption that the "as is" material was 100% pure. The yellow dye exhibited an absorp- maximum at about 320 millimicrons. the red dye at 500 millimicrons. The colorless dye (the resist agent) showed a rapid increase in absorption as the wave length decreased from 360 millimicrons; this increase reached a maximum at about 320 millimicrons.

The spectrophotometric data were used to calculate the concentrations of each of the dyebath components on each fabric (treated and untreated) and in the dyebath. The formulas used are given by Vickerstaff *(11)* and are derived from Anderson's thesis *(8)*. Solutions to the sets of three simultaneous equations were obtained with the aid of a Univac Scientific 1101 Computer.

The results of one experiment are presented in Figures 1 through 6.

DISCUSSION

Figure 1 illustrates the behavior of the yellow dye. This component left the dyebath rapidly, reaching maximum exhaustion at about point 7 (24 min, 169°F). The untreated sample absorbed yellow dye steadily and rapidly to point seven, when the rate of uptake suddenly increased. This corresponded to the point where this same dye began rapidly to be desorbed from the pretreated sample, which had absorbed the dye slowly at first, then rapidly (from points 4 to 5). From points 5 to 7 the amount of dye on the pretreated fabric remained essentially constant. After point 8, little change in the concentration of yellow dye in the bath or on either of the samples took place.

The red dye (Figure 2) exhausted from the bath slowly at first (during the first 20 minutes), then rapidly (from points 6 to 10, 161 °F to the boil), and finally more slowly (points 10 to 13, at the boil). For the first twenty minutes, very little red dye was taken up by the pretreated sample. After the temperature reached 161°F, the rate of uptake of this dye by the resisted sample increased somewhat. Little red dye was taken up by the untreated sample until the temperature reached 150°F. From point 5 to point 10, red dye was taken up rapidly by the untreated sample. Exhaustion from the bath decreased as did uptake of dye by the treated sample from point 10 to the end of the dyeing.

The behavior of the colorless dye, as illustrated in Figure 3, was quite interesting as well as quite unexpected. The appearance of three maxima in the curve depicting the change in the concentration of this component in the bath, with time and temperature, was obtained in all of the experiments, both those in which only one treated sample was dyed with an untreated, or when both samples were pretreated.

The colorless dye desorbed rapidly from the pretreated sample (the only source of this component in the system) during the first six minutes at room temperature (87°F). Some of this desorbed material was taken up by the untreated sample, the rest remained in the bath. As the temperature began to rise, the resist agent left the bath and the untreated sample and returned to the treated sample. During the time interval 4 to 5 (15 to 18 minutes; 136 to 150°F), the initial reactions repeated themselves. During the next nine minutes

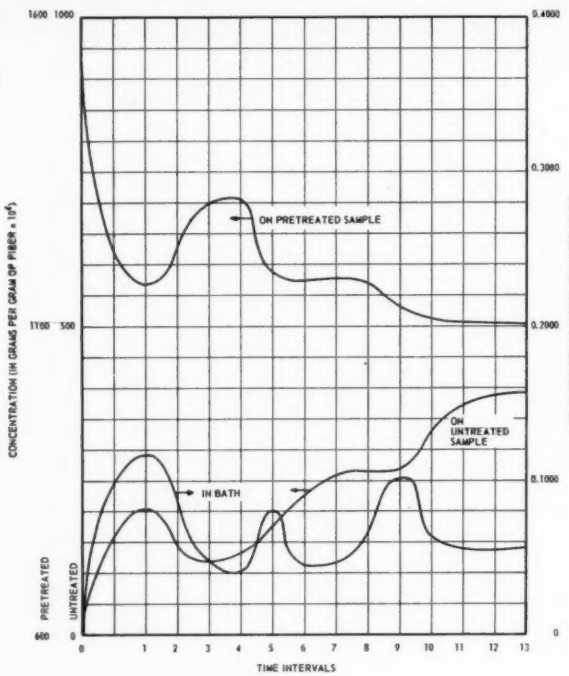

Figure 3
The colorless dye

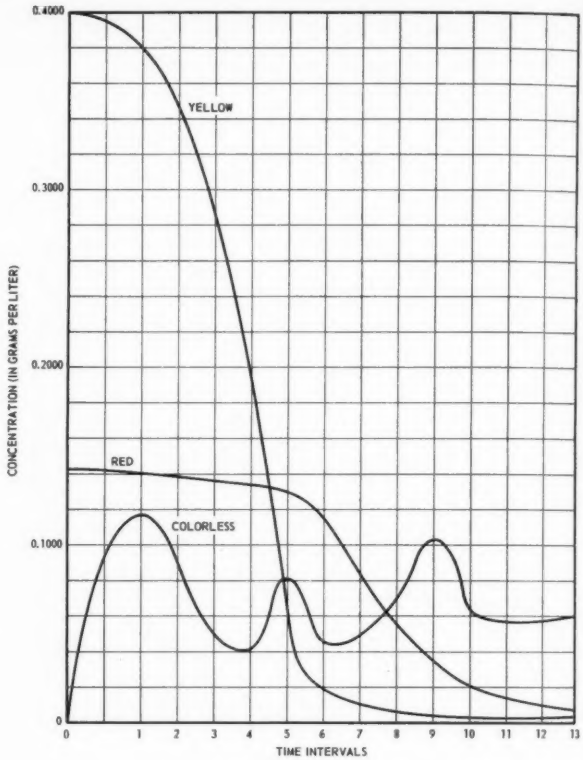

Figure 4
Components in the dyecloth

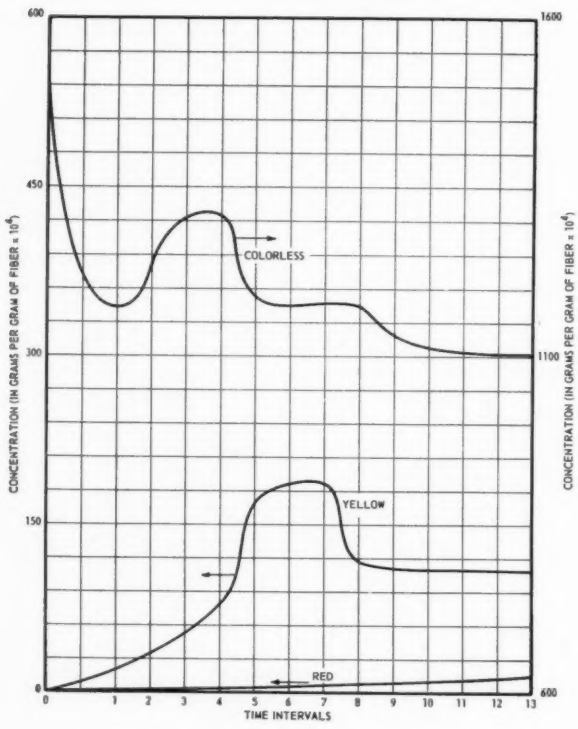

Figure 5
Components on pretreated fabric

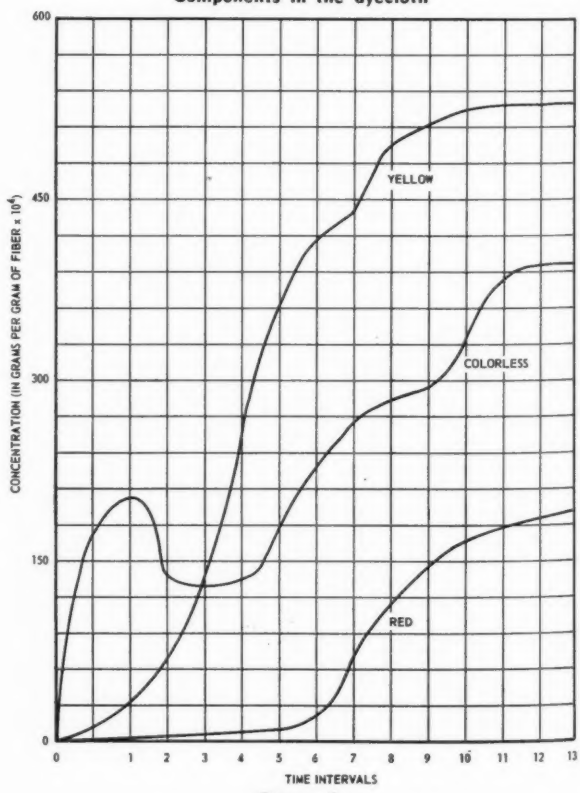

Figure 6
Components on untreated fabric

(Points 5 to 8), the concentration of resist agent on the pretreated sample remained constant, while its concentration on the untreated sample increased at the expense of the dyebath. Desorption from the pretreated sample began again, at a slow rate, at point 8 and continued at a decreasing rate to the end of the dyeing. The untreated sample continued to absorb dye at varying rates until the experiment was stopped. However, the concentration of this component in the dyebath again increased to a maximum at point 9, then decreased rapidly and finally quite slowly.

The final portions of the curves in Figure 3 (eg, from Point 11 to the end) seem to indicate that, if the reaction were allowed to run until equilibrium had been established, the concentration of the colorless dye in the dyebath would continue to decrease slowly, and the concentration on both treated and untreated samples would approach the same value.

Figures 4, 5 and 6 were prepared with the same curves plotted in the first three figures, except they have been regrouped to illustrate the behavior of the components in the dyebath, on the pretreated fabric and on the untreated fabric respectively.

Figure 4 illustrates the changes in concentration of the three dyes in the dyebath. It seems significant that exhaustion of the red dye was extremely slow until exhaustion of the yellow dye was essentially complete (Point 6). At about this same point the concentration of the colorless dye in the bath began to increase rapidly. The red dye, as it left the bath, was taken up rapidly by the untreated sample and slowly by the pretreated sample (cf Figure 2). By assuming that both red and yellow dye were competing for available sites on the wool, the greater concentration of the yellow dye would account for its ability to dye the wool first. Not until the concentration of yellow dye in the bath had been reduced to a very low value was it possible for the red dye to compete successfuly for sites on the fiber. Another possible explanation of the relative behavior of the red and yellow dyes was the effect of temperature; the red dye may require more heat than the yellow dye to effect its exhaustion from the dyebath.

The increase in the concentration of the colorless dye in the bath from Points 7 to 9, which occurred at approximately the same time as the red dye began to exhaust, may have been due to a displacement, by the red dye, of the resist agent on the pretreated fabric.

Figure 5 shows the changes in concentration of the components in the dyebath on the pretreated fabric. The initial rapid decrease in the concentration of colorless dye on the fabric when the fibers were first placed in the dyebath was of course to be expected. It will be noted that the pretreated fibers began immediately to take up yellow dye but that the rate of absorption of this component increased rapidly as the colorless dye was desorbed again (Points 4 to 5) from the fibers. This may have been due to a replacement of the colorless dye by the yellow one. The rapid desorption of yellow dye from the pretreated fabric (Points 7 to 8) corresponded to a rather sudden increase in the uptake of yellow dye by the untreated fabric (see Figure 6). During this time interval the amount of yellow dye in the bath decreased by only 0.001 g, the amount of this dye on the untreated sample increased by 0.05 g.

Figure 6 (Components on the Untreated Fabric) shows that, from Point 11 to the end of the dyeing, the change in concentration of yellow and colorless dyes on the fiber remained essentially unchanged; the concentration of red dye, however, was increasing. Prolonged boiling would result eventually in an equal distribution of dyestuffs on both the treated and untreated samples.

CONCLUSION

The results obtained in these experiments indicate that the mechanism by which contrast dyeing of wool is effected, by the process herein described, is quite complicated. It is believed that the observed results are determined by the relative (thermodynamic) affinities of the two dyestuffs and the resist agent used, as well as by their relative rates of reaction.

It is planned at present to continue the investigation into the mechanism of this process.

ACKNOWLEDGMENTS

This paper is a compilation of the work done by four graduate students at the A French Textile School in partial fulfillment of the requirements for the degree Master of Science in Textiles. The author wishes therefore to acknowledge the contributions of these four students: D Jack Davis[3], Arun Parikh, O M Anderson[4], and A F Cheatham Jr[5].

The author wishes also to thank E Grovenstein Jr, of the School of Chemistry at the Georgia Institute of Technology, for his assistance with the spectrophotometric portions of this work; and the members of the staff of the Rich Electronic Computer Center at the Georgia Tech Engineering Experiment Station for their help in solving the mathematical problems involved. The help of J W McCarty of the A French Textile School in the preparation of the manuscript is also gratefully acknowledged.

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(11) Vickerstaff, *op cit*, p47.

Correction

THE *Colour Index* Additions and Amendments Number #2 in the January 26, 1959 issue of the American Dyestuff Reporter, pages P56-P62 should be corrected as follows:

Page	*Item*		
P56	Page 1248	*Change*	Alizarine Deep Blue R
		to	Alizarine Azurol SE
P57	Page 1735	*Change*	Dispense Black 2
		to	Disperse Black 2
P60	Page 2604	*Change*	Naphtoelan Yellow CG Base
		to	Naphtoelan Yellow GC Base
P61	Page 2850	*Change*	Solvent Red 2B
		to	Solvent Red 24
P62	Page 4577	*Change*	Diazol Black BW
		to	Diazo Black BW

THE FINISHING AND DYEING OF FIBER GLASS DRAPERY FABRICS*

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Fiber glass drapery fabrics are finished by passing the greige fabric through an oven maintained at 1200° Fahrenheit and then through a pad-dyeing system. The intense heat of the first step removes all organic sizing on the glass and softens the glass, giving a permanent set to the weave, which makes the fabric permanently wrinkleproof. The fabric passes from the thermal scour into a finishing bath in which resins and pigments are applied. This step is followed by a cure and an aftertreatment to give water repellency and washfastness.

Two new developments have added a new color dimension to the one-color fabrics resulting from the resin-pigment dyeing process. One technique for developing multicolored glass fabrics, without resorting to printing, depends upon the selective capillarity of various glass fiber yarn forms. The other development is the use of yarns which have been dyed with inorganic pigments capable of withstanding the super temperatures of the glass finishing process.

The continuing expansion of the market for fiber glass decorative fabrics means a greatly increasing need for finishes designed specifically for fiber glass decorative fabrics.

INTRODUCTION

THE use of glass fibers has shown spectacular growth in the last decade. Production increased 655 percent in the last 12 years. One estimate (*1*) of fiber glass demand is 600 million pounds per year by 1975. The use of fiber glass fabrics in household applications—especially in the fabrication of curtains, draperies, and shower curtains—is keeping pace with the overall demand for glass fiber. Some five million pairs of glass draperies were sold in 1957, according to one source (*2*).

To sustain this anticipated growth, new finishing techniques for fiber glass fabrics must be developed and absorbed. This year has seen great improvement in the so-called conventional resin-pigment coating systems, plus the commercial development of multicolored fiber glass fabrics with cross dye effects. The thermic scouring and weave setting of fiber glass fabrics at temperatures in excess of 1000°F have been an obstacle to the usual procedure of getting cross-dyed effects with organic fibers by using dyed yarns or mixed fibers. The obstruction to the cross-dyed fiber glass decorative fabric has been removed by the use of two distinctly different methods. In one, glass yarns are dyed with inorganic pigments carefully chosen to withstand the high temperatures encountered in finishing glass fabric. In the other method, glass fabrics are woven from combinations of continuous filament, texturized, and boucle glass yarns. The surface characteristics of these yarns are sufficiently dissimilar so that cross dye effects result when the fabrics styled with the various glass yarn forms are dyed by padding through a resin-pigment system. Even more striking effects can be obtained by overdyeing either the yarn-dyed fabrics or the fabrics woven using the various glass-yarn forms.

An entirely new and dramatic decorative dimension has been added to decorative fiber glass fabrics, without detracting from any of the basic features of glass.

*Presented October 31, 1958 during the 37th National Convention at the Conrad Hilton Hotel, Chicago, Ill.

SIZE REMOVAL

The first operation in the continuous finishing of fiber glass decorative fabrics is the removal of any organic material on the glass. This is done by passing the fabric through a gas-fired muffle furnace maintained at between 1100 and 1350° F (*3,4,5*).

Most textile glass fabrics are coated with a lubricant and binding agent, which is applied as the glass fiber is being produced. A typical treatment (*6,7*), often referred to as the starch-oil size or binder, is necessary to protect the glass fiber during throwing, beaming, quilling, and weaving. The starch used may be one of many of the starches familiar to the textile technologist and may include slightly hydrolyzed or dextrinized starches. The oil in the starch-oil binder is generally a lubricating oil of vegetable origin, such as castor, hydrogenated cottonseed, olive, or cocoanut. In addition to these primary components, the binder may contain, in extremely small amounts, one or more substances such as gelatine, borax, polyvinyl alcohol, cationic surface-active materials, and dispersing agents.

A typical formulation in percentages by weight for a starch-oil size, which must be removed from the fiber glass fabric is:

2.00%	Hydrogenated cottonseed oil
8.00%	Partially dextrinized starch
0.06%	Gelatin
0.13%	Polyvinyl alcohol
0.20%	Partial esters of fatty acids and hexitolanhydrides combined with polyoxyethylene chains
0.04%	Fatty imidazoline derivatives
89.21%	Water

This size is applied to the glass fiber by the yarn producer as the fiber is being formed. These organic solids, which must be removed, range from 0.5 percent to 4.0 percent on commercial glass yarns with the starch-oil size. In addition to the sizing applied by the yarn producer, any additional organic materials, such as warp sizings or oils, put on by the weaver must be completely removed.

The greige fabric is passed through the 1200° F oven into which air or oxygen is bled carefully, at such a rate that the organic material is ignited and completely burned from the glass.

The high heat of the combustion process softens the glass, setting the glass yarn permanently in the configuration of the weave. This crimping, the most important feature of the heat-treating process, results in a wrinkleproof fiber glass fabric.

As the glass comes out of the heat-cleaning oven, it is completely devoid of interfiber protection. A protective coating must be applied at once.

RESIN-PIGMENT DYEING

The present commercial method of dyeing and adding the needed protection to the heat-cleaned fiber glass fabric is the use of an aqueous dispersion system of pigment dyeing.

The resins used must be chosen so that they do not detract from the properties of the glass and must be capable of meeting the requirements of a good pigment binder. The resin system must be flameproof; sufficiently flexible that the glass fabric is not stiff and brittle and its wrinkleproof properties not reduced; resistant to ultraviolet radiation, fungus attack, atmospheric gases; have high abrasion and washfastness characteristics; control yarn slippage; and of course, have good pigment-binding characteristics.

In addition, the system must give level dyeing, have good bath stability, result in no pad buildup, and be economical.

It is a big order, and getting the proper materials has resulted in a careful screening of literally thousands of combinations.

A composition of a typical dried film used as a pigment binder is, in percent by weight:

Polyacrylonitrile	35%
Polytetrafluoroethylene	35%
Colloidal silica	15%
Pigment	15%

Additions to this formulation might also include polyethylene and silicone softeners.

After the resin-pigment system has been padded on the fabric and cured, the fabric is then passed through a bath of a water repellent to insure washfastness. The material used presently is a stearato chromic chloride complex.

Until recently, the water repellent was omitted from goods to be screen printed. The recent development of a print system which anchors to the chrome-complex-treated fabric now allows the finisher to supply one finish for plain, screen print, and "kiss" print machine applications *(8)*.

DYED YARN FABRICS

The use of the pigment-resin dyeing procedure has resulted in fiber glass fabrics in only one shade or color. In order to get multicolored fabrics, it was necessary to develop dyed glass yarns which would not lose color in the high heat of the heat-treating ovens.

Recently, fabrics woven from glass yarns have been dyed with inorganic pigments. The inorganic pigments used for dyeing the glass include such materials as cadmium salts, antimony salts, gold salts, carbon black, aluminum, copper, chrome salts, molybdenum salts, iron oxides, copper oxides, and other metallic salts with color value. The glass yarns are either warp dyed and beam twisted or single-end dyed.

Cross-dye effects can be obtained by overdyeing the yarn-dyed fabrics with the resin-pigment systems.

MIXED-YARN-TYPE FABRICS

Another method of obtaining multicolored or shade fiber glass fabrics is the dyeing of fabrics woven from glass fibers with different surface characteristics using the pigment-resin system. The recent introduction of glass fibers which have been bulked or texturized has allowed the finisher to take advantage of the selective capillarity of glass yarns in mixed forms. Using one, two, three, or more baths of various colors, a wide range of color effects can be obtained.

CONCLUSION

Since the days when the first fine filaments of glass fibers were pulled from the platinum bushing, there has been constant improvement in the glass and the resins used to coat the glass. The creativity and imagination of the textile technologist and chemist seem to be the only limiting factors in the continuing growth of glass fiber usage in drapery fabrics.

ACKNOWLEDGMENT

The author wishes to express his appreciation to Henry S Falls, William M Lybrand Jr, and John Wilson, who provided much of the information and data upon which this paper is based.

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Nonwoven Fabrics——

(concluded from page 42)

ing at the best and most practical construction. Outstanding contributions in nonwovens have been coming from application development groups of such fiber suppliers as Celanese Corp of America, The Chemstrand Corp, E I duPont de Nemours & Co, Inc, American Viscose Corp, and others. The efforts of my own company are typical of responsible binder suppliers. B F Goodrich Chemcial Co's Product Applications Laboratory centered at Avon Lake, Ohio is working continually on new applications for commercially proven binders, evaluating new and improved binder types or modifications, and conducting compounding studies aimed at enhancing particular end-use properties. Few suppliers can operate from such a broad base as is offered by the polyvinylchlorides, nitriles, acrylics, and polyvinylacetate, but each is prepared to provide detailed information and assistance in his particular product area.

THE MATURING MARKET——

The properties, advantages, and deficiencies of various fibers have been frequently reviewed. Obviously there is no universally practical construction based either upon a particular fiber system of binder type. One of the speakers at this meeting is covering the subject of acrylic thermoplastic binders, which are finding a growing market where good appearance and excellence of aging stability are desirable. These materials, sold under such trade names as Hycar and Rhoplex also possess good durability and lend themselves well to compounding modifications. Other highly efficient binder types include the polyvinyl chlorides, which were previously mentioned, the butadiene-acrylonitriles, polyvinyl acetate, and butadiene-styrene polymers. Of all types, the most widely used in commercial practice at present are those based upon polyvinyl chloride, butadiene-acrylonitrile, and polyvinyl acetate. Because of the complexity of high polymer manufacture and the diversity of polymer types and resultant properties, it is difficult for individuals or companies weighing their potential position in nonwoven manufacturing to decide where to start their study. It is suggested that these people take advantage of the knowledge accumulated by the various fiber, equipment, and binder suppliers. The "veil of mystery" that surrounded the industry in previous years has been fairly well dispersed as more companies have entered into active commercial manufacture. Highly acceptable standardized web-forming equipment is typified by the Rando-Webber, a product of Curlator Corp. Saturation equipment is offered by several leading manufacturers. Also, there is a better general understanding of wet web handling, web drying, and methods of handling raw materials and finished product. Entrance to the field is now an "eyes open" problem rather than a speculative risk.

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37th National Convention———

THE INFLUENCE OF FINISHES ON THE PROPERTIES OF FIBER GLASS TAPES AND FABRICS*

EDWIN L LOTZ
Hess, Goldsmith & Co. Inc
A member of Burlington Industries

This paper describes the method and techniques of applying various industrial finishes, and outlines the influence of these finishes on the physical and electrical properties of the fabrics.

INTRODUCTION

FIBER GLASS yarns are manufactured by melting glass at a high temperature (2400°—2800°F) in specially made bushings or furnaces equipped with very small holes in the bottom. As the molten glass runs through these holes, the fibers are pulled at a very high rate of speed to reduce the diameter to the desired value. As the fibers are being pulled out of the bushing, they are sprayed with a binder, which serves to hold the individual filaments as an integral part of the yarn and allows it to be unwound, plied and twisted into various size yarns before it is woven into cloth. The binder serves two purposes: first, *it maintains strand integrity* and, second, *it protects the fibers from physical breakage* during handling and weaving.

For many applications, this binder is left on the yarns and has no adverse effect on the final product. For other applications requiring the ultimate in wet strength, physical and electrical properties, it is necessary to remove this binder and replace it with a finish designed to give specific properties.

As the yarn diameter increases, the fibers need more and more protection, so that the original binder no longer supplies enough protection and the weaving mills must then add a warp sizing directly over the binder in order to weave the coarser yarns into acceptable fabrics. The use of singles yarn (unplied yarn with one tpi) always requires a warp sizing to protect the fibers during weaving. Table I illustrates this point.

In these fabrics it is necessary to remove both the binder and the warp sizing before applying a finish. If the fabrics or tapes are used in the greige state, both the binder and the warp size must be such that they do not produce an adverse effect in the intended use. In other words, they must be compatible with the entire system.

TAPES———In tape weaving it is not necessary to warp size any yarns, so all tapes contain only the original binder. This is due to the narrow width (¼″ to 1½″) and the type of loom used in weaving.

In general terms, the binder consists of starch, vegetable oil and small amounts of resin and cationic softener in water. Since the warp sizing must be compatible with the binder, it too consists of a starch-resin-water system.

REMOVAL OF THE BINDER AND SIZING

It will be of interest to review the various methods for finishing glass fabrics for industrial use and to examine the advantages and disadvantages of each method.

BATCH-OVEN OR HEAT PROCESS———The most popular method for removing the binder and sizing from glass cloth and tape is the "batch-oven" process, in which large quantities of material are placed in an oven heated with high-velocity circulating air. The heat cycle is very carefully controlled to apply a gradually increasing temperature gradient to the glass, which causes a slow volatilization of the organic material in the binder.

The length of the heat cycle varies from 65 to 75 hours with a maximum temperature of 650°—675°F.

Once the fabric has been heat cleaned, there is nothing to be gained by extending the time of the cycle or by repeated cycles. This is shown in Figure 1, which depicts the relationship of physical strength to exposure at 650°F.

The resultant product is a clean glass fabric with a slightly alkaline surface possessing a physical strength of 30% to 40% of the original greige strength. It is now ready to accept the finish which can be chemically combined with the clean glass surface.

The main disadvantage is the reod are: 1) its simplicity; 2) low cost; and 3) uniformity from roll to roll and batch to batch.

The main disadvantage is the reduction of the physical strength of the fabric.

CHEMICAL CLEANING — DETERGENT SCOURING — ENZYME DESIZING———Since we are attempting to remove a known organic material from glass cloth, it is relatively easy to select a chemical cleaning bath that will dissolve or wash out the binder.

Pilot plant runs in a standard "crab", or boil-off machine, using enzymes, alkyd treatment, and sequestering agents at 212°F produced a fabric with the organic material reduced to only 0.10%, which is an acceptable level.

Fothergill & Harvey of England have a patented process using a trichloroethylene bath followed by a mild heat-cleaning treatment. This

TABLE I
Yarn construction vs sizing

Fabric	Const	Yarn	Binder	Warp sizing	Total organic content
127	42 x 32	450 3/2 x 450 3/2	yes	no	2.0
128	42 x 32	225 1/3 x 225 1/3	yes	no	2.0
HG-28	42 x 32	150 1/2 x 150 1/2	yes	no	2.0
330	32 x 28	150 1/0 x 150 1/2	yes	yes	3.5
HG-30	42 x 32	75 1/0 x 75 1/0	yes	yes	3.5

*Presented October 31, 1958 during the 37th National Convention at the Conrad Hilton Hotel, Chicago, Ill.

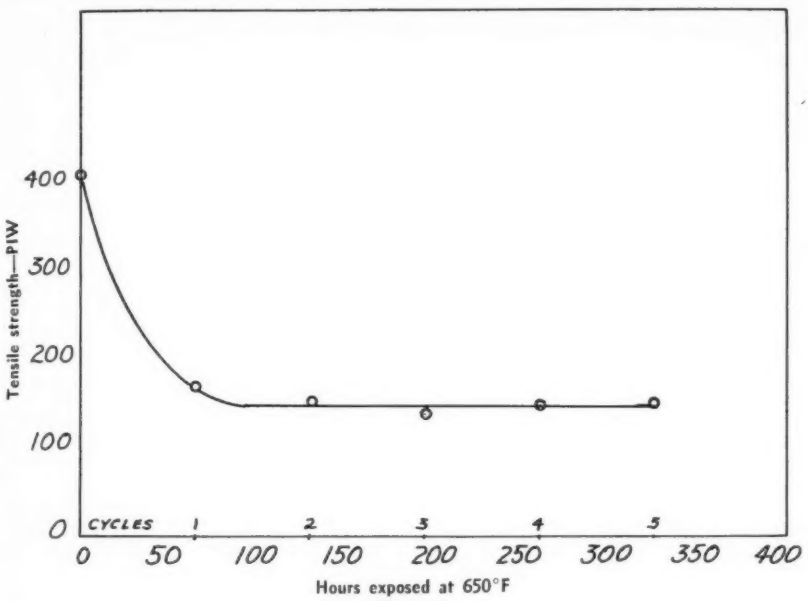


Figure 1

Effect of repeated batch-oven cycles on physical strength of 181 glass

process preserves more of the strength of the fabric but the results on laminates *do not reflect* this increase.

The results of our own chemical-cleaning process are shown in Table II.

The superiority of the batch-oven heat-cleaned material is quite evident in the wet strengths of the laminate.

The one advantage of the chemical method is in the fact that the fabric retains a higher percentage of its physical strength. This strength, however, is not reflected in the resulting laminate.

Disadvantages are: 1) high cost; 2) distortion of fabrics.

TABLE II
Chemical cleaning vs heat cleaning of glass fabrics

181 FABRIC

Physical properties	*Chemical 1*	*Chemical 2*	*Batch oven-heat*
Original organic content	2.1	2.0	2.2
Organic content after cleaning	0.08	0.08	0.07
Original tensile strength	418	430	426
Tensile after cleaning	305	266	160

LAMINATE RESULTS

Volan Finish—Polyester Resin

⅛" Laminate—38 ± 2% Resin Content

Dry compression	41,500	47,200	44,000
Wet compression	29,500	29,600	32,300
Dry flexural	63,900	63,700	69,300
Wet flexural	44,200	46,300	54,800
Dry tensile	54,200	60,100	56,600
Wet tensile	56,400	49,900	54,900

ULTRASONIC DESIZING——Removal of the binder and warp sizing by ultrasonic means was successful on a laboratory basis. Organic content was reduced to 0.08% with a satisfactory physical-strength retention.

Laminate results, however, were lower than regular batch-oven heat-cleaned material, particularly in wet compression.

When the chemical and ultrasonic methods are combined with a further heat treatment, the results are equal to the batch-oven process.

APPLICATION OF THE VARIOUS FINISHES

After the fabric has been cleaned in the proper manner, the application of the finish is a relatively easy process. It consists of continuously passing the fabric into the finish bath for complete immersion and then through padder rolls set at appropriate pressures to control the wet pick-up on the cloth. The fabric is then dried by forced hot air. Some finishes require mild washing, which is done by a series of tandem washers, followed by drying. The washing process is automatically controlled by conductivity measurements on the discharged water.

TYPES OF FINISHES USED ON INDUSTRIAL FABRICS

The most popular finishes in use today (approx 90% of all fabrics and tape sold) are as follows:

VOLAN A——After being heat cleaned, the fabric is completely saturated with methacrylate chromic chloride in such a manner that the chrome content of the finished fabric is between 0.03% and 0.05%. The fabric is very thoroughly washed after the methacrylate chromic chloride is cured to remove certain soluble chlorides which are formed. This finish is recommended for use with polyester, epoxy, and phenolic laminates which require good dry- and wet-strength properties.

Polyester laminates made with Volan A finish will meet requirements of Federal Specifications MIL-P-8013-B and MIL-F-9084-A.

GARAN——After being heat cleaned, the fabric is passed through a silane-type chemical and dried under very carefully controlled conditions so as to leave a vinyl-silane on the surface of the glass. This finish gives excellent dry- and wet-strength properties with polyester resins and will meet the requirements of MIL-P-8013-B and MIL-F-9084-A.

A-1100——After being heat cleaned, the fabric is completely saturated with gamma-aminoprophytriethoxysilane and thereafter dried. This finish is recommended for use with phenolic, epoxy and melamine resins. The laminates show excellent wet and dry properties and will meet the requirements of Specifications MIL-R-9299 and MIL-R-9300-A.

A-172——After being heat cleaned, the fabric is completely saturated with a silane-type chemical and dried under very carefully controlled conditions so as to leave a vinyl-silane on the surface of the glass. This finish gives excellent dry- and wet-strength properties with polyester resins and will meet the requirements of MIL-P-8013-B and MIL-F-9084-A.

210——This finish was developed especially for promoting adhesion of silicone rubber to glass fabrics and consists of a special method for removing the oil and starch binder to a level of 0.125% or less; and, at the same time, retaining practically all of the original greige tensile strength of the fabric. A patent has been applied for on this finish.

I-516——The fabric is heat treated and processed under very carefully regulated conditions so as to control the amount and nature of the residue left on the fabric. This finish is re-

commended for use with melamine laminates.

NEUTRAL Ph 7———After being heat cleaned, the fabric is treated with an acid to neutralize the surface and is then very thoroughly washed. Its main use is in silicone laminates.

EFFECT OF FINISH ON PHYSICAL STRENGTH OF CLOTH OR TAPE

The batch-oven heat-cleaning process will normally reduce the tensile strength of the fabric or tape to about 30% to 40% of its greige state value. Table III serves to illustrate this effect.

TABLE III
Tensile strengths, heat cleaning and finishing

	Fabric		
Finish	*181*	*HG-28*	*112*
Greige	426	310	130
Greige & polyethylene glycol 518		350	140
Heat cleaned	160	100	55
H C & polyethylene glycol	256	120	80
Volan A	265	135	85
A-1100	210	110	75
Garan	190	115	70
172	220	108	75
210	330	240	105
I-516	360	270	110
Neutral Ph 7	150	100	40

The effect of the finish on the physical properties of polyester laminates is shown in Table IV. Similar results are obtained with other resins.

A-1100, 210 and I-516 finishes are not used with polyester resins.

EFFECT ON ELECTRICAL PROPERTIES

Table V shows the effect of various finishes on the electrical properties of melamine- and epoxy-resin laminates. Measurements of power factor and dielectric constant at one megacycle were used for the standard conditions. Wet conditions consist of immersion in water for 24 hours at room temperature.

FINISHES RECOMMENDED FOR VARIOUS RESINS IN PLASTIC LAMINATES

The finishes recommended for various resins in plastic laminates are as follows:

Recommended finishes for Various Resins

Epoxy laminates—Volan A, A-1100

TABLE IV
Effect of finishes on physical properties of 181 polyester laminate

	Greige	*112 Finish*	*Volan A*	*Garan*	*172*
Compression					
Dry	25,900	31,400	41,900	39,250	34,500
Wet	11,000	11,500	33,500	35,500	34,100
Flexural					
Dry	41,200	54,400	70,400	64,650	57,000
Wet	25,300	28,200	52,800	55,760	54,000
Tensile					
Dry	64,000	46,500	58,600	47,700	56,400
Wet	53,500	37,000	55,200	49,200	49,700

TABLE V
Electrical properties of melamine laminates (HG-28)

		Power factor		*Dielectric constant*	
	Water absorb	*dry*	*wet*	*dry*	*wet*
Volan A	1.80%	.0107	.0235	7.14	7.39
A-1100	1.18%	.0108	.0289	7.24	7.80
210	1.29%	.0104	.1053	7.15	9.48
I-516	0.39%	.0111	.0116	7.03	7.14
112	2.50%	.0186	+.08	6.70	+10.0
111	1.75%	.0131	+.10	6.94	+10.0

Electrical properties of epoxy laminates (HG-28)

Volan A	.07%	.0117	.0118	5.02	5.11
A-1100	.08%	.0106	.0109	4.75	4.80
I-516	.05%	.0114	.0116	5.02	5.08

Melamine laminates—1-516, 111, A-1100

Phenolic laminates—Volan A, A-1100

Silicone laminates—Neutral Ph 7, 136

Polyester laminates—Volan A, Garan A-172

OTHER FINISHES

Throughout this paper, I have spoken of only seven finishes. This by no means covers all the finishes that are available commercially. They do, however, represent the ones used in volume. A listing of other finishes will serve to show their specialized uses.

NOL-24———After being heat cleaned, the fabric is immersed in roll form in a xylene solution of NOL-24 held at an elevated temperature until the reagent combines with the glass. Excess NOL-24 is removed by washing the roll of fabric in xylene repeatedly, after which it is dried, washed in water in open width, and again dried. This treatment leaves a silane-type finish on the glass, which renders it suitable for use with polyester, epoxy, phenolic and melamine resins.

136———Silane finish, which, after drying, leaves a cinyl-silane on the surface of the glass. Suitable for use with polyester and silicone resins.

T-31———Silane-type finish. Suitable for use with polyester, epoxy, phenolic and melamine resins.

114———Chrome - complex — no washing. Suitable for use with polyester.

EXPERIMENTAL BINDERS

All of the yarn producers are constantly trying to improve their yarns and their binder systems. It is, however, a very difficult task to satisfy all the requirements of an ideal binder because the demands made on it are at opposite points. It must perform at the bushing through twisting and plying, weaving and finishing, protecting the fibers all the way and then, finally, it must be compatible with all the various coating systems imposed upon the fabric.

At the present time, Owens-Corning Fiberglas Corp is conducting extensive laboratory testing on a new nonstarch binder, known as #650. When the work is complete, it will be offered to the weavers who will then repeat all their own testing. If all agree that it offers an improvement, it will then be field-tested for final acceptance by the ultimate users of the fabric.

CONCLUSION

A) The best method for removing the binder and sizing from glass cloth is the batch-oven, or heat, process.

B) Many commercial finishes have been developed to fit specific resins for use in plastic laminates. All of these finishes are designed to improve wet-strength properties of the laminate.

COUNCIL REPORT

213th Meeting • January 30, 1959 • New York, N Y

WELDON G HELMUS, newly elected 15th president of AATCC, was introduced to the Council by George P Paine, executive secretary, on the occasion of the body's 213th meeting, held January 30, 1959 at the Sheraton-McAlpin Hotel, New York, N Y.

In his message, President Helmus asked for, and was granted authority to set up the following Special Committees: Committee on Individual Membership, Herbert A Stauderman, chairman; Study Committee on Endowment Fund, P J Wood, chairman; and Study Committee on Location of National Headquarters (chairman to be appointed).

Regarding individual membership, Mr Helmus stated, "We have discussed increasing our individual membership list but have no organized method of handling the subject as we do in the case of Corporate Members. While I doubt that we can do a real intensive job this year, if I have your approval to specifically charge a committee with this responsibility, we can be ready to reach that goal of 10,000 members starting the latter part of this year."

The Study Committee on Endowment Fund, according to Mr Helmus, would study the possibility of setting up an endowment fund by taking a substantial portion of the Association's funds to be placed in an irrevocable trust, which could increase by bequests which might be left in the Association's custody.

Regarding the third committee, Mr Helmus stated, "Since the location of our National Headquarters has been discussed in the press, and considering that many of our members do not know of our present commitments at Lowell, it is only fair to our present 'landlord,' who supplies us with free space and who is now completing a new building which we might occupy the latter part of this year, that we give 'him' some idea of what lies ahead. We now have a commitment to the fall of 1963. There has been open discussion about a possible move to the South in order to be closer to the new textile centers. If anything is to be done on this subject, it is not too early to investigate the situation and I, therefore, ask for your permission to appoint a study committee on location of national headquarters."

Mr Helmus also proposed a general dues increase, stating . . . "Our Association has a permanent staff of fourteen full-time employees and four part-time people. They perform essential services that make our national organization hang together and provide background and continuity for Association programs in the face of ever-changing committee memberships. We rely heavily on them to help up maintain a smooth-running organization.

"We have a very definite responsibility to these people. They, like any other group of employees, are entitled to expect from the Association reasonable and up-to-date management policies, particularly with regard to their salary levels and so-called fringe benefits. This is also important so that we can attract and keep the kind of qualified person who will provide, in the long run, the best investment for those salary dollars. I am not entirely satisfied that we have met these responsibilities as fully as some of us would like.

"There have been increasing demands from various segments of AATCC for more extensive services from National Headquarters — for conventions, membership promotion, publicity, technical and section activities, to name but a few. This, of course, means more manpower, trained and experienced to meet the needs of a healthy and growing Association, such as ours.

"If we want to expand and grow we must look seriously at our finances. While it is true we have certain capital assets, they were put there over the years by previous conservative administrations. It is also true that these assets draw interest in an amount over $12,000 per year, and in my discussions I have found no one anxious to break into these capital funds. We, therefore, must operate entirely from our current income.

"On this basis, as you know, we are running close to deficit financing, and every time we want to do something, we find ourselves in a financial straight jacket. You have before you a study on dues of other similar associations. We give twenty-six issues of the *Dyestuff Reporter* and a copy of the *Technical Manual,* which alone is worth the ten dollars we now pay. Our expenses, like those of all other businesses, continue to increase. I therefore propose that our dues be raised to $15 for senior and associate members, $7.50 for junior members and $5 for student members. I have submitted this proposal to the Appropriations Committee."

* * *

In appropriate ceremonies, Past President Raymond W Jacoby presented a Past President's Pin to George O Linberg, who now joins the Council as a permanent member. Mr Helmus cited the "tremendous effort" Mr Linberg had put into his job over the past two years, stating that "we all thank him sincerely and know that he will continue his interest in our future development."

* * *

President Helmus welcomed new vice presidents C T Anderson (Central Atlantic Region) and W George Parks (New England Region). New Councilors for 1959 include E B Bell, R J Peirent, and G F Quigley of the Northern New England Section; T Larson and E W Lawrence, Rhode Island; G S Wham, Metropolitan; T R Foltz Jr, Niagara Frontier; M J Reider and W S Sollenberger, Delaware Valley; W E Rixon and R E Rupp, Piedmont; J D Mosheim, South Central; J W Richardson, Southeastern; and E I Stearns, Mid-West. (For a complete list of National Officers, Councilors, and Sectional Officers for 1959, see "Organization of AATCC," page 60 of this issue).

* * *

The President's nominations for Committees of the Council were approved as follows ("S" signifying Standing Committee):

EXECUTIVE COMMITTEE ON RESEARCH (S)—C W Dorn, *chairman;* C A Sylvester, *vice chairman;* H W Stiegler, *secretary;* V B Holland, J H Jones, S J Kennedy, G O Linberg, H E Millson, J D Mosheim, G S Wham.

PUBLICITY (S)—E Artim, *chairman;* P J Luck, *vice chairman;* section publicity chairmen, ex-officio.

APPROPRIATIONS (S) — R E Derby, *chairman;* R W Jacoby, G P Paine, T R Smith, P J Wood.

MEMBERSHIP AND LOCAL SECTIONS (S) — E Morrill, *chairman;* C T Anderson, G P Paine, W G Parks, H G Smith.

TECHNICAL SUPPLIES (S)—G P Paine, *chairman;* R E Derby, C W Dorn, W G Helmus, H W Stiegler.

PUBLICATIONS[1] (S)—P J Luck, *chairman;* N A Johnson, *secretary;* W D Appel, editor of *Technical Manual;* E Artim, M A Dahlen, C W Dorn, C Z Draves, W A Holst, G D Jackson Jr, R W Jacoby, A E Johnson, E W Lawrence, G O Linberg, E Morrill, H A Rutherford, P B Stam, C A Whitehead.

CONSTITUTION AND BYLAWS (S)—W A Holst, *chairman;* W B Griffin, E R Kaswell

CORPORATE MEMBERSHIP (S) —A E Johnson, *chairman;* G P Paine, *secretary;* C T Anderson, E Morrill, W G Parks, H G Smith, *vice chairmen;* section corporate membership chairmen, ex-officio.

COLOUR INDEX MARKETING[2]

BIBLIOGRAPHY — W H Cady, *chairman;* M S Furry, R D Greene, V I McLendon, R K Worner, A S Wrigley.

TECHNICAL PROGRAMS (S)— A M Sookne, *chairman;* H J Crail, A E Culp Jr, F Fortess, A J Kelley, C B Ray, H A Rutherford.

INTERSECTIONAL CONTEST — T J Gillick Jr, *chairman;* R E Derby Jr, A H Gaede, K A Howry, L G Johnston.

CONVENTIONS (S) — E R Kaswell, *chairman;* D E Marnon, L Smith, *one year;* B K Easton, E Morrill, *two years;* W B Griffin, R B Taylorson, *three years;* F V Traut, *four years.*

SUBJECT AND SPEAKERS' BUREAU (S)—M J Babey, *chairman;* C A Whitehead, *secretary;* section program chairmen, ex-officio.

ARCHIVES (S)—S M Edelstein, *chairman;* W H Cady, R W Jacoby, N A Johnson, M J Lydon, G P Paine, A R Thompson, P J Wood.

[1]Merged with Colour Index Marketing Committee.

[2]Merged with Publications Committee.

Past president Raymond W Jacoby (left) pins Past President's Pin on Geo O Linberg as President Weldon G Helmus looks on during 213th meeting of the Council held January 30th in New York.

QM-AIR FORCE DYE SURVEY —Changed in status to TCR Reference Committee, W A Holst, *chairman.*

INTER-SOCIETY RELATIONS (S)—C Z Draves, *chairman;* W D Appel, J R Bonnar, C W Dorn, R B Hallowell, R W Jacoby, H W Stiegler, C A Sylvester.

TECHNICAL COMMITTEE ON RESEARCH (S) — C A Sylvester, *chairman;* G S Whem, *vice chairman;* G J Mandikos, *secretary;* R C Allison, W D Appel, E C Atwell, M J Babey, C A Baker, K H Barnard, C H Bayley, J R Bonnar, D G Carmichael, V L Chase, E J Chornyei, H D Clayton, W E Coughlin, M A Dahlen, J N Dalton, C W Dorn, C Z Draves, B F Faris, F Fortess, K R Fox, E Freedman, P J Fynn, A H Gaede, N F Getchell, H E Hager, J J Hanlon, A K Haynes, H F Herrmann, A E Hirst, V B Holland, W A Holst, G H Hotte, R W Jacoby, N A Johnson, J H Jones, E R Kaswell, S J Kennedy, J Labarthe, E W Lawrence, C W Lever, G O Linberg, L S Little, E M Lynch Jr, A R Macormac, J E Meile, H E Millson, L R Mizell, J D Mosheim, J E Norton, A D Nute, W F Prien, F A Prisley, C N Rabold, F J Rizzo, R E Rupp, B A Ryberg, C H A Schmitt, F T Simon, G M Smith, R B Smith, T R Smith, R H Souther, P B Stam, J G Stass, R L Stutz, A F Tesi, P Theel, L S Thompson, F Tripp, A R Wachter, J F Warner, H E Wilde, M W Winkler, P J Wood, R K Worner, C L Zimmermann. Councilors representing local sections or their appointed alternates and chairmen of Research Committees are ex-officio members of the Technical Committee on Research.

TEXTILE EDUCATION (S)—H A Rutherford, *chairman;* J Anderson, S M Cone Jr, H A DesMarais, B K Easton, E H Gamble, R W Jacoby, A F Tesi.

EMPLOYEE RETIREMENT AND PENSION—W J Hamburger, *Chairman;* R E Derby, D C Newman, P J Wood.

SERVICE AWARDS—A H Gaede, *chairman;* W D Appel, J Lindsay Jr, D W Robinson, C A Sylvester.

COLOUR INDEX SUPPLEMENT EDITORIAL—W D Appel, *chairman;* J R Bonnar, A G Brunier Jr, W H Cady, W A Holst, R W Jacoby, G R Thomson.

STUDY COMMITTEE ON NOMINATING PROCEDURES — A H Gaede, *chairman;* J Anderson, W H Bertolet III, E A Chevrette, J J Derrig, B K Easton, H W Ellsworth, E R Kaswell, P J Kennedy, J E Lynn, E Morrill, R E Newman, L Smith, H G Smith.

STUDY COMMITTEE ON INTERSECTIONAL CONTEST—T J Gillick, *chairman;* L J Armstrong, W B Griffin, T H Hart, J D Mosheim, A H Rant, F J Rizzo, N A Truslow.

STUDY COMMITTEE ON LONG-RANGE OBJECTIVES — E R Kaswell, *chairman;* J R Bonnar, M A Dahlen, C W Dorn, M Harris, S J Kennedy, N A Truslow.

The President is an ex-officio member of all committees (Bylaws, Art III, Sec 1). The executive secretary is an ex-officio member of all committees of the Council (minutes of the 201st Council meeting, April 20, 1956).

* * *

The executive secretary's financial report and the report of the treasurer were accepted as submitted. In addition, a motion to allow the treasurer to take advantage of favorable market conditions and purchase stocks, bonds, securities, etc, in an amount not to exceed $500 without prior consent of Council but with the approval of the Appropriations Committee was passed.

* * *

Charles A Sylvester, reporting briefly for the Technical Committee on Research, announced that 28 meetings of TCR and its subcommittees had been held January 28-29. He called attention to the influence of the newly formed Committee on Statistical Methods on other TCR committees, and cited the cooperation between the national committee on Damage Caused by Retained Chlorine and that of the Piedmont Section's committee.

* * *

Charles W Dorn, chairman, reported for the Executive Committee on Research as follows:

1) ECR has reviewed the status of the flammability situation and amended slightly the report of the Flammability Committee for the 1959 *Technical Manual.*

2) ECR has approved the following changes in the chairmanships of certain Research Committees:

a) Resistance to Abrasion — Norman B Gobeil succeeds T F Cooke.

b) Colorfastness to Crocking (Rubbing)—Charles R Trommer succeeds Henry E Millson.

c) Definitions — John H Menkart succeeds L R Burgess.

d) Evaluation of Desizing Agents—Frederick J DiCarlo succeeds P V Seydel.

e) Dermatitis — David W Fasset succeeds J A Zapp Jr.

f) Drycleaning Test Methods — Robert T Graham succeeds Albert E Johnson.

g) End-Usage Performance Tests —Albert E Johnson succeeds Jules Labarthe.

h) Identification of Finishes on Textiles—T D Miles succeeds B R Norwick.

i) Evaluation of Fire-Resistant Textiles—W George Parks succeeds L L Heffner.

j) Flammability of Clothing Textiles—Cameron Baker succeeds R C Geering.

k) Colorfastness to Perspiration—C H A Schmitt succeeds C Minoff.

l) Colorfastness to Pleating—C W Saalfrank succeeds J E Meile.

m) Colorfastness to Wet and Dry Pressing—William Anderson succeeds M W Goodell.

n) Stream Sanitation — P Theel succeeds R H Souther.

o) Weathering of Textiles — L L Heffner succeeds F J Rizzo.

p) Wash and Wear—Graham Richardson succeeds George S Wham.

In addition, ECR has approved the following new committee members:

a) Louis Mizell replaces Milton Harris on the Technical Committee on Research.

b) L C Kolodny replaces W von Bergen on the Committee on Water Resistance of Fabrics.

c) Max Silverman joins the Committee on Drycleaning Test Methods.

d) Alfred W Spencer joins the Committee on Colorfastness to Washing.

e) John P McNally joins the Committee on Resistance to Abrasion.

3) Formation of a new committee on Determination of Odor in Resin-Treated Fabrics was approved by ECR with the following personnel: P J Fynn, *chairman;* Francis K Burr. Ernest Gurry, Leonard B Hallows, M Earl Heard, William H Masterson, Robert C Squier, J Edward Smith, Paul B Stam, and R L Wayland Jr.

4) Appointment of Virgil D Lyon to represent ASA on the ISO Committee on Colourfastness to Vulcanization was approved.

5) The chairman of TCR asked for the sum of $2,500 for use by the Committee on Weathering of Textiles. This request was granted subject to approval by Council.

6) ECR decided that a short history of each test method, ie, when the method was originated as a tentative method, the date it was made a standard method, how often and when reviewed, and short statement of what changes were made, should appear as a footnote for each test method in the 1959 *Technical Manual.*

7) The chairman of TCR was instructed to write a letter to each Local Section asking that TCR be informed of all present and proposed research projects at the section level in order that TCR might give all help possible to these endeavors. This in no way relates to Intersectional Contest papers.

8) At the request of W A Holst, chairman of the QM-Air Force Dye Survey Committee, ECR voted to request the Council discharge this Committee and make it a reference committee under TCR with Mr Holst as reference chairman.

9) ECR approved editorial changes in TTM 76-1954 "Determination of the Electrical Resistivity of Fabrics."

10) The question of complete removal of finishes from fabrics in order to facilitate quantitative analysis was discussed and it was decided to review this subject with ASTM to see if the formation of a joint committee is desirable.

11) A report on the high-temperature dyeing project conducted at Philadelphia Textile Institute has been received but not discussed. Copies will be sent to ECR members as soon as possible.

Council approved all action called for by the Executive Committee on Research.

* * *

Piedmont Section Councilor Paul B Stam announced that Vice President H Gillespie Smith is recovering from an illness and would be unable to perform his duties for the present. Mr Stam announced further that it was Mr Smith's recommendation that A Henry Gaede act as vice president from the Southern Region until he was able to resume his duties. Council approved the recommendation.

In the absence of provision in the Constitution and Bylaws for such an occurrence, it was voted that Councilors from the individual regions study the situation with an aim towards incorporating a permanent procedure in the Bylaws.

* * *

Council viewed a color film entitled "Textile Chemistry—Field with a Future," which is sponsored by Wica Chemicals, Inc and produced under the supervision of the Walter J Klein Agency. The film, which is to be shown at high schools and colleges, as well as on television, invites inquiries for further information from AATCC Headquarters. Council approved use of AATCC seal and address at end of film plus use of a promotional brochure prepared by the Walter J Klein Agency with a

reply card addressed to AATCC. The proposed brochure would list the universities and colleges offering a degree in textile chemistry and the prospective student would be asked to check his or her preference. These would then be forwarded to the various colleges.

* * *

For the Committee on Membership and Local Sections, Elliott Morrill reported a current membership of 7247, an increase of 367 since May 1, 1958.

* * *

For the Colour Index Marketing Committee, Roland E Derby called attention to the fact that the Committee had been merged with the Publications Committee, but would continue to function under this new arrangement. He cited the outstanding work of Glenn D Jackson Jr in the preparation of a multicolor promotional brochure on the *Colour Index,* which appears in this issue of *American Dyestuff Reporter,* and which will be used in an intensive direct mail selling campaign.

* * *

Reporting for the Colour Index Supplement Committee, William D Appel called attention to the efforts of his Committee in exchanging data with the British; inviting North and South American (except Canadian) manufacturers of dyes and pigments to submit data on their new products; and submitting quarterly lists of *Colour Index* additions and amendments to the *American Dyestuff Reporter* for publication.

* * *

For the Publications Committee, Edward W Lawrence announced the appointment of Paul B Stam as a judge for the 1959 American Dyestuff Reporter Award. Hector C Borghetty, chairman, and Carl Z Draves will complete the judges panel for this year.

The Publications Committee has approved the publication of quarterly lists of amendments and additions to the new *Colour Index* in the *Proceedings* and has authorized Mr Appel to make arrangements with the British for reprints of the material, which will be published simultaneously in the *Journal of the Society of Dyers and Colourists* in the same type face and style as that in the *Colour Index.*

* * *

For the Intersectional Contest Committee, Thomas J Gillick Jr reported that seven Sections had expressed interest in presenting papers at the Washington Convention. Mr Gillick was assured by Leonard Smith, general chairman of the 1959 Convention, that the Contest would once again be one of the highlights of the Annual Meeting. Mr Gillick heads a new study committee concerned with the future of the Intersectional Contest, which, he pointed out, has no official status in the Association at present.

* * *

Discussion of proposed amendments to the Bylaws providing for an Executive Committee of the Council was tabled until the next meeting of Council in order that new Councilors might acquaint themselves with the content.

The proposed wording follows:

Article III, Section 1:

The President shall preside, or appoint the presiding officer, at each meeting of the Association or of the Council at which he may be present. He shall call each meeting of the Council, except as provided in the next Section of this Article, through written notice from the Executive Secretary to each Council member, or during incapacity of the Executive Secretary, through the Treasurer. He shall be ex-officio a member of all committees.

Article III, Section 4:

The Executive Secretary shall perform such administrative duties as the Executive Committee by authority of the Council may delegate to him. The Executive Secretary shall report to the Executive Committee, and subject to the Council and the Executive Committee, shall be responsible for the administration and management of the staff operations and for the work of the employees of the Association. He shall recommend to the Executive Committee the salaries of staff members, provided that such salaries shall be subject to review, upon request of the Council, at the time of the presentation of the annual budget.

Article III, Section 6:

Any question which might properly be submitted to vote in a Council meeting may, in an emergency, be submitted to the Council through letter ballot, in form acceptable to the Executive Committee.

Article IV, Section 1:

Except where otherwise specified, the following Standing Committees of the Council with chairmen shall be appointed annually: an Executive Committee of the Council, an Executive Committee on Research, a Technical Committee on Research, . . .

Sections 2 to 18 to be renumbered to become 3 to 19 in order that a new Section 2 may be added as follows:

Article IV, Section 2:

The Executive Committee of the Council shall be composed of the President, as Chairman, the Vice Presidents, the Treasurer, the latest living Past President, the Chairman of the Executive Committee on Research, and the Executive Secretary as a non-voting member.

The Executive Committee, subject to the Council, shall exercise general supervision of the management of the Association and perform such duties as the Council delegates to it. It shall conduct the affairs of the Association in accordance with policies established by the Council. The Executive Committee shall consider broad Association policy and make recommendations and reports to the Council.

The Executive Committee shall recommend to the Council, for approval, the members of standing and special committees established by the Constitution, Bylaws, or Council. It shall coordinate the policies of all standing and special committees and recommend to the Council such additional special committees as the Executive Committee deems necessary.

The Executive Committee shall review the annual budget prepared by the Appropriations Committee and make to the Appropriations Committee any recommendations considered desirable before the budget is presented to the Council.

The Executive Committee shall be responsible for the management of the office of the Association and shall employ an Executive Secretary, a suitable staff, and necessary professional services. It shall recommend to the Council, for approval, the salary of the Executive Secretary.

Meetings of the Executive Committee shall be held in conjunction with Council meetings and at such other times as the Committee considers desirable. A Vice President unable to attend a meeting of the Executive Committee shall appoint an alternate to represent his region. Five voting members of the Executive Committee shall constitute a quorum.

Minutes of all meetings of the Executive Committee shall be mailed to Council members.

* * *

For the Conventions Committee, Ernest R Kaswell called on 1958 Convention Chairman Elliott Morrill for a report. Mr Morrill stated that all major bills had been paid, and it

appeared that the results would show a 5-7% loss. He volunteered the comment that the absence of commercial exhibits accounted for an attendance which was 150 below expectations, not to mention the attendant revenue from same.

Mr Kaswell stated that he still felt that the concept of rotating the Convention city was sound, and hoped that the Committee would see fit to continue the practice.

Leonard Smith, reporting on the progress of the 1959 Convention, announced that an exhibit prospectus would be mailed in March. He stated that attendance at the Washington Convention is expected to be in excess of 2000, which would make it the biggest in the history of the Association.

Council authorized the obligation of funds in the amount of $18,100 to defray 1959 Convention expenses.

* * *

Albert E Johnson, reporting for the Corporate Membership Committee, announced that the number of Corporate Members at the end of the year stood at 282, which was yielding $56,375 in dues. He stated that the Association's individual membership constituted approximately 2000 organizations, which he regarded as a good "prospect list" for additional Corporate Membership.

Mr Johnson commented that the decline in Corporate Membership had been arrested and that the campaign was "on the upgrade." He called attention to the four-page folder which had been sent to present Corporate Members, which he termed an "Annual Report." The new "Manual of Procedure for AATCC Research Committees" has also been mailed to Corporate Members.

* * *

Council approved the appropriation up to $150 for a Service Award Scroll and President Helmus asked the Association's vice presidents to name men from their respective regions to serve on the Service Awards Committee.

* * *

In other action, Council approved the transfer of $1664 from the General Expense Fund to the Colour Index Marketing Fund.

* * *

Mr Derby, for the Appropriations Committee, announced that a special meeting on the proposed pension plan for Association employees would be held before April.

* * *

For the Committee on Inter-Society Relations, Chairman Carl Z Draves recommended several personnel changes, which were approved by Council. William D Appel replaces Leonard S Little as an AATCC representative with voting power on ASA Committee L23—U S Committee for ISO/TC 38 on Textiles. George Wham replaces Mr Little as a representative with voting power on Joint ASTM-AATCC Committee on Textile Testing. Rudolph C Geering replaces Herman E Hager as a representative with voting power on test methods and apparatus and only advisory power on standards for safe fabrics on Standing Committee for Commercial Standard 191-53 for the Flammability of Clothing Textiles. Mr Geering was also named to represent AATCC in the National Fire Protective Association.

* * *

President Helmus has called for a meeting of the Council on April 3, which will be held in New York at the Hotel Sheraton-McAlpin. The following meeting will be held May 29 in Montreal, Canada.

Membership Applications

SENIOR

Paul R Edinger——Tech sales rep, Shell Chemical Corp, Atlanta, Ga. Sponsors: J W Ivey, V B Holland. (P).

William C Harrington——Mgr, General Processors Inc, Arroyo, PR. Sponsors: O F Habel, G E Neisser.

L Egbert House Jr——Chemist, Proctor Chemical Co, Salisbury, NC. Sponsors: E E House, W L Beaumont. (P).

James F Hull——Salesman, Columbia-Southern Chem Corp, Atlanta, Ga. Sponsors: C B Ray, G L Dozier. (S).

Victor M Kumin——Research engr, Kendall Co, Walpole, Mass. Sponsors: R Whitman, E J McNamara. (NNE).

Josph E Marhefka——Dyer, Blackstone Mills Inc, Clinton, Mass. Sponsors: H C Schuffels, H A Morrison. (NNE).

Anderson McKeehan——Dyer, Crescent Hosiery Mills, Notia, Tenn. Sponsors: E V Helms, S J Martin, Jr. (SC).

Mervyn B Mitchell——Chemist, Shell Chemical Corp, Union, NJ. Sponsors: H A Rutherford, K S Campbell. (M).

Rene M Noordtzij——Tech chemist, Sandoz Inc, New York, NY. Sponsors: C H A Schmitt, R A Lindenmaier. (M).

Arthur L Tinsley——Ware Shoals Div, Riegel Textile Corp, Ware Shoals, SC. Sponsors: G Reynolds, J H O'Neil. (P).

JUNIOR

Elton B McCausland Jr——Salesman, Ciba Co, Inc, New York, NY. Sponsors: P J Luck, E H Hart. (M).

Angel U Perales——Boss dyer, Textile Dye Works, Inc, Arroyo, PR. Sponsors: J W Rogenmuser, V T Hartquist.

ASSOCIATE

James M Byne III——Tech sales rep, Becco Chemical Div, Charlotte, NC. (P).

John L Hewitt——Sales engr, International Salt Co Inc, Scranton, Pa. (P).

Donald W Lynch——Mgr, engineering, Home Laundry Dept, General Electric Co, Louisville, Ky. (MW).

Donald C McGiehan——Owner, D C McGiehan Co, White Plains, NY. (M).

David Rogoff——Textile engineer, U S Testing Co, Inc, c/o Arkwright Inc, New York, NY. (M).

Convention Notes

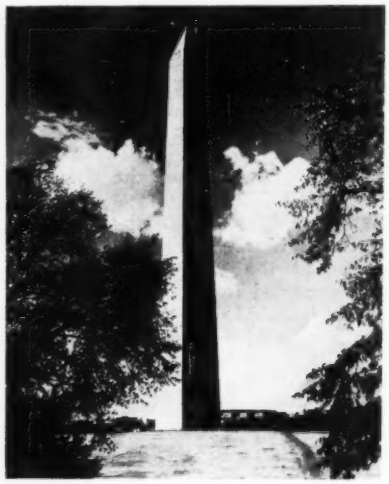
THE Convention Committees are working assiduously, laying plans for the 1959 Annual Meeting, which looms as the largest and one of the most interesting of AATCC Conventions. It is not too early to begin making your plans to attend the Convention, which will be held October 8-10 at the Hotels Sheraton-Park & Shoreham, Washington DC, under the auspices of the Southern Region. Ralph Carr, chairman of the Reception Committee and Esther Batchelder, chairman of the Ladies Committee, have made elaborate plans for making your visit to Washington an enjoyable and memorable one.

Many AATCC members have never visited Washington, the Capitol of our nation, and will want to avail themselves of this unusual opportunity to enjoy the Convention and see some of the historical, scientific and cultural points of interest. Guided tours of the important points of interest are being arranged by Dr. Batchelder for the ladies, and it is predicted that these trips will be of such unusual interest that many of the men will also want to go along. It is possible that Dr Batchelder may be able to make arrangements for private and smaller groups to visit special attraction in addition to the plans being made for the larger groups.

A note to Dr Esther Batchelder at the following address:

Room 116, Center Bldg
ARS, USDA Agricultural Research Ctr
Beltsville, Md

will have Dr Batchelder's careful consideration and assistance.



Washington Monument

United States Capitol

View of Washington, DC, from top of Washington Monument looking down the Mall towards the Capitol

AATCC Calendar

COUNCIL, COUNCIL COMMITTEES, RESEARCH COMMITTEES

April 1-3 (Hotel McAlpin, New York, NY)
April 1—Research Committees
April 2—Council Committees, TCR, ECR
April 3 (AM)—Council Meeting
May 29, 1959 (Mount Royal Hotel, Montreal, Canada) AM-Council meeting; PM-Joint luncheon and technical session with CATCC

NATIONAL CONVENTIONS

Oct 8-10, 1959 (Sheraton Park and Shoreham Hotels, Washington, DC); Oct 6-8, 1960 (Sheraton Hotel, Philadelphia, Pa.); September 28-30, 1961 (Buffalo, NY); 1962 (Southern Region)

HUDSON-MOHAWK SECTION

April 3 (Chelsea House, Tribes Hill, NY); May 15 (Ladies night, Albany area); June 26 (Annual outing—Antlers Country Club, Tribes Hill, NY)

METROPOLITAN SECTION

Feb 27 (Kohler's Swiss Chalet, Rochelle Park, NJ)

MID-WEST SECTION

May 2 (Schroeder Hotel, Milwaukee, Wis); June 12-13 (Outing—Brown Lake Resort, Burlington, Wis)

NIAGARA FRONTIER SECTION

April 4 (Hamilton, Ont—joint meeting with CATCC)

NORTHERN NEW ENGLAND

Mar 20 (Hotel 128, Dedham, Mass)

PIEDMONT SECTION

April 10-11 (Robert E Lee Hotel, Winston-Salem, NC); June 5-7 (Outing—Grove Park Inn, Asheville, NC); Sept 25-26 (Barringer Hotel, Charlotte, NC)

RHODE ISLAND SECTION

Mar 20 (Providence Eng Soc, Providence, RI); Apr 24 (Student Night); June 12 (26th Annual Outing, Metacomet CC); Sept 18 (Management Night); Oct 23 (Prov Eng Soc, Providence, RI); Dec 4 (Annual Meeting, Johnson's Hummocks Grille, Providence, RI)

SOUTH CENTRAL SECTION

Mar 21, Sept 19 (Hotel Patten, Chattanooga, Tenn); June 26-27 (Outing—Riverside Hotel, Gatlinburg, Tenn)

SOUTHEASTERN SECTION

April 18 (National Guard Armory, Cedartown, Ga); June 12-14 (Summer Outing—Radium Springs, Ga); Sept 12 (Ida Cason Callaway Gardens, Pine Mtn, Ga); Dec 5 (Atlanta, Ga)

WESTERN NEW ENGLAND SECTION

Mar 6 (Manero's Restaurant, Berlin, Conn); Apr 17 (Rapp's Restaurant, Shelton, Conn); May 15 (Ladies' Night—Rapp's Paradise Inn, Ansonia, Conn); June 12 (Outing—Wallingford, Conn); Sept 25 (Blake's Restaurant, Springfield, Mass); Oct 23 (Annual Meeting—Rapp's Restaurant, Shelton, Conn); Dec 4 (Hartford, Conn)

Employment Register

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.

59-2

Education: BS, chemistry, Brooklyn College; BS, dyeing and textile chemistry, Bradford Durfee College of Technology.

Experience: Textile chemist; manager, dyeing & finishing plant. (Complete resume on request).

Position desired: Managerial—administrative or technical production and quality control.

Location desired: East coast—anywhere.

Age: 34; married; veteran; references.

COMMITTEE ON ANTIBACTERIAL AGENTS

IN THE tentative test method 90-1958 "Detection of Antibacterial Property of Fabrics—Agar Plate Method" published on page P8 of the January 12th issue, the personnel of the Committee was incorrectly listed. It should have been as follows:

I Schwartz, *Chairman*	C C Deuber
H E Wilde, *Secretary*	J Chapin*
L H James	E N Kramer
Miss J Spangler	M Dudarevitch*
Miss E McNeil*	T F Cooke
Miss L Dettmer	

* Cooperating nonmember.

AATCC WASH-AND-WEAR TEST REPRINTS AVAILABLE

GREAT interest has been shown in AATCC Tentative Test Method 88-1958, "Wash-and-Wear Fabrics—Appearance After Home Laundering," since it was published in the August 25, 1958 issue.

For the convenience of AATCC individual and corporate members, as well as other readers of the American Dyestuff Reporter, a second reprinting of the article is planned.

Orders for 50 or more reprints will be considered.

Single copies may be obtained, while the supply lasts, from AATCC National Headquarters, Box 28, Lowell, Massachusetts.

Activities of the Local Sections

Piedmont

THE Piedmont Section held its Winter Meeting in Greenville, SC, at the Poinsett Hotel on January 23 and 24, 1959. Total registered attendance was 293.

The meeting was highlighted by several notable speakers and events. Henry E Millson, 1958 Olney Medalist, was guest speaker at the morning sectional research meeting, attended by some 250 members and guests. Mr Millson discussed mechanics of dyeing with special emphasis on carrier dyeing. This presentation was colorfully illustrated by both slides and motion pictures.

The technical meeting, attended by some 150 members and guests, followed the research committee meeting in the afternoon. The following program was presented at this meeting:

Presentation of the Piedmont Section's Intersectional Contest first-prize-winning paper by Neal A Truslow: "The Effect of Heat Treatment on Thermoplastic Fabrics."

"Epoxy Blended Finishes for White Cottons," Fred B Shippee, Gagliardi Research Corp.

"Triazones, Creaseproofing Agents for White Cottons," R Lee Wayland Jr, Dan River Mills.

A social hour followed the technical meeting.

Some 110 members and guests attended the banquet at which time Joseph C King, chairman of the Piedmont Section, presented a copy of the *Colour Index* to Charles Stowe, librarian, Greenville Public Library. Romayne A Barnes, chairman of the Board of Trustees, expressed the appreciation of the city and library for this gift from the Piedmont Section.

Past chairman W E Rixon presented the National AATCC Treasurer's check to Neal A Truslow for the winning Intersectional Contest Paper.

Arthur R Thompson announced to the members the recent passing of an old and respected member, Max Einstein. A short period of memoriam was held.

The banquet speaker, Rev F Howard Wheeler, gave an enlightening talk on some of the experiences of an exchange pastor on coming to the US on a pulpit exchange from Weymouth, England to Due West, SC. Joseph C King, Metro-Atlantic, Inc, presided as chairman of the Piedmont Section, and William Iannone, also of Metro-Atlantic, was sectional committeeman in charge.

Metropolitan

THE Metropolitan Section will meet this Friday, February 27, at Kohler's Swiss Chalet, Rochelle Park, NJ. Three speakers will present papers on the general theme of "Application of Resins to Textiles." The speakers will be: T F Cooke, American Cynamid Co, "Chemistry of Resins"; A C Neussle, Rohm & Haas Co, "Other Chemicals Used with Resins"; and Charles Minoff, Texstyle Corp, "Practical Mill Applications." Donald Gagliardi, consultant, will preside as moderator at a discussion session following the papers. There will be no verbatim transcript made of the discussion.

Western New England

GUEST speaker at the Western New England Section's January 23rd meeting, held at Rapp's Restaurant, Shelton, Conn, was Frank J Lachut, Owens-Corning Fiberglas Corp, Ashton, RI, who spoke on the subject, "Decorative Fabrics from Fibrous Glass".

The Section has voted to hold its annual sectional meeting for the election of officers shall be the first meeting held after October 1st.

Hudson-Mohawk

A HEAVY snow storm on January 16th cut down the attendance at the Hudson-Mohawk Section's meeting, which was held at Jack's Restaurant, Albany, NY. Irwin J Smith, Advisory Committee chairman, presided over the meeting in place of the snow-bound officers, who were not able to attend.

Speaker of the evening was Philip B Roth, manager, Textile Chemicals Applications Laboratory, American Cyanamid Co, who spoke on "The Performance Characteristics of the New Triazine Formaldehyde-Based Crosslinking Agent for Cellulosic Fabrics".

The date of the next meeting of the Section has been moved up to April 3rd. It will be held at the Chelsea House, Tribes Hill, Amsterdam, NY.

ORGANIZATION OF THE AATCC

FOUNDER

LOUIS A OLNEY
(deceased)

COUNCIL OF THE ASSOCIATION

PRESIDENT .... WELDON G HELMUS, Fair Lawn Finishing Co, Fair Lawn, NJ

VICE PRESIDENTS ..... (*New England Region*): W GEORGE PARKS, University of Rhode Island, Kingston, RI; (*Central Atlantic Region*): C T ANDERSON, Ciba Co, Inc, 4241 N 2nd St, Philadelphia, Pa; (*Southern Region*): H GILLESPIE SMITH, American Cyanamid Co, 1370 Spring St, NW, Atlanta 9, Ga; (*Western Region*): ELLIOTT MORRILL, The Best Foods, Div Corn Products Co, 1437 West Morris St, Indianapolis 6, Ind

TREASURER ....ROLAND E DERBY, Textile Aniline & Chemical Co, Box 899, Lawrence, Mass

EXECUTIVE SECRETARY ..... GEORGE P PAINE, AATCC National Headquarters, PO Box 28, Lowell, Mass

CHAIRMAN, EXECUTIVE COMMITTEE ON RESEARCH ..... CHARLES W DORN, 1 Monfort Rd, Port Washington, NY

PAST PRESIDENTS (Living) ..... ELVIN H KILLHEFFER, P J WOOD, WILLIAM H CADY, CARL Z DRAVES, THOMAS R SMITH, WILLIAM D APPEL, HENRY F HERRMANN, C NORRIS RABOLD, J ROBERT BONNAR, RAYMOND W JACOBY, GEO O LINBERG

NATIONAL COUNCILORS REPRESENTING SECTIONS.....
(*Northern New England*): EDWARD B BELL, ROBERT J PIERENT, GERALD F QUIGLEY; (*Rhode Island*): REMUS F CAROSELLI, THORWALD LARSON, EDWARD W LAWERNCE, J WILLIAM TIMPERLEY; (*Western New England*): JOHN E HIRN; (*Delaware Valley*): WILLIAM H BERTOLET 3RD, THOMAS H HART, MALCOLM J REIDER, DONALD W ROBINSON, WILLIAM S SOLLENBERGER; (*Hudson-Mohawk*): JOHN J HANLON; (*Metropolitan*): ARTHUR J KELLNER, PAUL J LUCK, DONALD E MARNON, RICHARD P MONSAERT JR, BRENDEN F QUIGLEY, GEORGE S WHAM, MAX W WINKLER; (*Niagara Frontier*): THOMAS R FOLTZ JR; (*Piedmont*): CLARENCE HOOPER, EDWARD A MURRAY, WARREN E RIXON, RAPHAEL E RUPP, PAUL B STAM, NEAL A TRUSLOW; (*South Central*): JACK ANDERSON, JOE D MOSHEIM; (*Southeastern*): WILLIAM E FAYSSOUX, T HOWARD McCAMY, JOE W RICHARDSON; (*Washington*): LEONARD SMITH; (*Mid-West*): ARTHUR I HULTBERG, JOSEPH H JONES, EDWIN I STEARNS; (*Pacific Northwest*): JOHN L AYRES; (*Pacific Southwest*): MELVILLE H BEHRENDT

TREASURER EMERITUS

WILLIAM R MOORHOUSE
PO Box 352, South Yarmouth, Mass

CHAIRMEN, COMMITTEES OF THE COUNCIL

STANDING COMMITTEES—

Executive Committee on Research	CHARLES W DORN
Technical Committee on Research	CHARLES A SYLVESTER
Publicity	EDWARD ARTIM
Appropriations	ROLAND E DERBY
Membership and Local Sections	ELLIOTT MORRILL
Publications	PAUL J LUCK
Corporate Membership	ALBERT E JOHNSON
Constitution and Bylaws	WILLIAM A HOLST
Conventions	ERNEST R KASWELL
Technical Programs	ARNOLD M SOOKNE
Technical Supplies	GEORGE P PAINE
Archives	SIDNEY M EDELSTEIN
Intersociety Relations	CARL Z DRAVES
Textile Education	HENRY A RUTHERFORD
Subject and Speakers' Bureau	MATTHEW J BABEY

SPECIAL COMMITTEES—

Bibliography	WILLIAM H CADY
Intersectional Contest	THOMAS J GILLICK JR
Employee Retirement and Pension Committee	WALTER J HAMBURGER
Service Awards Committee	A HENRY GAEDE
Colour Index Supplement Editorial Committee	WILLIAM D APPEL
Study Committee on Nominating Procedures	A HENRY GAEDE
Study Committee on Intersectional Contest	THOMAS J GILLICK JR
Study Committee on Long Range Objectives	ERNEST R KASWELL
Study Committee on Endowment Fund	P J WOOD
Committee on Individual Membership	H A STAUDERMAN
Study Committee on Location of National Headquarters	(To be appointed)

NATIONAL HEADQUARTERS

SENIOR STAFF

Executive Secretary	GEORGE P PAINE
Director of Research	HAROLD W STIEGLER
Technical Manager	GEORGE J MANDIKOS
Administrative Manager	J ROBERT THOMPSON
Research Associate	GLEN M KIDDER
Research Associate	HARLAN E GLIDDEN

LOCAL SECTION OFFICERS

New England Region

NORTHERN NEW ENGLAND. *Chairman:* ROBERT D ROBINSON Bachmann-Uxbridge Worsted Corp, Uxbridge, Mass; *Secretary:* JOSEPH S PANTO, Fabric Research Labs Inc, 1000 Providence Highway, Dedham, Mass; *Vice Chairman:* EDWARD J McNAMARA; *Treasurer:* WILLIAM W PENNOCK

RHODE ISLAND ..... *Chairman:* ROBERT H PHILLIPS, Cranston Print Works Co, Cranston, R I; *Secretary:* HARRISON M GORTON JR, Koppers Company, Inc, 1430 Elmwood Ave, Providence, R I; *Vice Chairman:* JOHN J ROARKE; *Treasurer:* HAROLD B STURTEVANT

WESTERN NEW ENGLAND *Chairman:* ANDREW W GOODWIN, Princeton Knitting Mills, Watertown, Conn; *Secretary:* TIMOTHY J HORAN, Princeton Knitting Mills, Echo Lake Rd, Watertown, Conn; *Vice Chairman:* ALBERT H RANT; *Treasurer:* ALEXANDER H DeMARCO

Central Atlantic Region

DELAWARE VALLEY ..... *Chairman:* L KEVIN McCHESNEY, Leatex Chemical Co, 2722 N Hancock St, Philadelphia 33, Pa; *Secretary:* ERNST W EMPTING, Verona Dyestuffs, 357 Lancaster Ave, Haverford, Pa; *Vice Chairman:* CLARENCE A SEIBERT; *Treasurer:* EDWARD G HAACK

HUDSON-MOHAWK .....*Chairman:* MAURICE FISHMAN, Lee Dyeing Co, Johnstown, NY; *Secretary:* ACHILLES MAFILIOS, Ritter Chemical Co, Amsterdam NY; *Vice Chairman:* FLOYD J SZUREK; *Treasurer:* WALTER DRAUTZ

METROPOLITAN ..... *Chairman:* JOHN A KOMNINOS, Waldrich Company, River Rd, Delawanna, NJ; *Secretary:* RICHARD P MONSAERT JR, American Felt Co, 350 Fifth Ave, New York, NY; *Vice Chairman:* PERCY J FYNN; *Treasurer:* RICHARD E MILLER

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STUDENT CHAPTERS

Alabama Polytechnic Institute, Bradford Durfee College of Technology, Clemson College, Georgia Institute of Technology, Lowell Technological Institute, New Bedford Institute of Technology, North Carolina State College, Philadelphia Textile Institute, Rhode Island School of Design

FEBRUARY FANTASIA
1959

Inter Alia — Inter Nos

P J WOOD

HUMAN RELATIONS

Burton Hillis writes a column in Better Homes & Gardens, which in our considered opinion combines all the features that a successful column should contain. It is entertaining, humorous and informative.

In a recent issue he refers to and quotes a note handed to him by his minister, Rev Dr George Hall, bearing on the matter of establishing and maintenance of good human relations. It is based on the use of words, one of our favorite playthings.

Here's the very note; this is what he wrote: The five most important words — "I am proud of you". The four most important — "What is your opinion?" The three most important — "If you please. . . ." The two most important — Thank you". The least important — "I".

As Elmer might say, in his whimsical way, "Ain't it the truth?"

GROWTH

Ultracrepidarian critics might find fault with this segment as being irrelevant, immaterial and other harsh adjectives and invectives, but we thought it would be of interest to most of the chemists, dyers, finishers, printers and textile tycoons that we know, some of whom we have observed pushing patiently on a grocery wagon on one or other of the premises of the subject. On our first experience with this operation, we felt somewhat embarrassed, judging that we might be cutting a rather ludicrous figure, but one becomes hardened to such things, as some people do to sin. Seeing people whom we have always considered to be the acme of propriety and gentility indulge in this occupation without any trace of embarrassment, today we can say we blush no longer when so occupied.

Of course those of our friends blessed with a flock of progeny, Eddie Brophy and John Caprio for instance, who have eight or more children apiece, having served an apprenticeship to baby carriage propelling, have an enormous advantage over us in this pursuit.

All of which brings to mind that one little store which was started under the grandiose name of the Great Atlantic and Pacific Tea Company in 1859, in Vesey Street, New York City. And now look at it. Truly it has grown up to its name.

MORE WORDS ABOUT WORDS

As last year closed we gave a thought to the life of that great American lexicographer, Noah Webster. (Requiem aeternum dona ei, Domine).

In a day or two from this time of writing, we will be celebrating the birthday of a distinguished English physician, Peter Mark Roget, who, in addition to his service to humanity by the practice of medicine, rendered incalculable benefit to the wielder of words.

He wrote that monumental work, Thesaurus of English Words and Phrases, which does not gather words together alphabetically as Webster did, but places them in categories of association.

We have two copies of this valuable reference book. One that was given to us by a Sunday school class of many years ago, and another printed by Pocket Books Inc in pocket form. In this format Thomas Y Crowell Co published, from 1923, 10 printings, Pocket Book; from 1946 published 14 printings; and the same company in the Cardinal Edition put out 10 printings.

The backs are off our original full-size copy and the Cardinal Edition copy is looking very dog-eared, both facts bearing witness to the heavy use we make of this incomparable compilation.

It appears that the learned doctor was born in 1779, just 180 years ago next Sunday.

Incidentally, the word Thesaurus is Greek and the meaning of it is a treasury, which indeed the word resembles phonetically. It is therefore a treasury of English words, etc.

* * *

In a former article in which we mentioned a booklet, Report Writing, we said we were going to send for a companion publication titled Tips on Talking. We did. It came today, and appropriately enough it was mailed to us by J N Fairhead, who is Lecturer in Communication — Spoken, in the Birmingham College of Technology, with his compliments, for which we here publicly thank him.

Whatever we said concerning the good qualities of the previous book, we could repeat about this one. Any man with a prodigious memory, like Harry Millson or Henry Herrmann or Henry Grimes or Arthur Wood, could commit the whole treatise to memory, all the 16 pages of it. The words that come readily to mind while perusing this compendium are concise, laconic, pithy, terse, specific, explicit, graphic, articulate and comprehensible. We haven't run out of applicable words, but this typewriter ribbon is getting weak.

HEXACHLOROEPOXYOCTAHYDRODIMETHANONAPHTHALENE

Recently we referred to DIELDRIN, an insecticide used extensively for agricultural purposes and now being developed as an efficient (and durable) mothproofing agent. Above is its chemical name.

When we were a boy, the commonly accepted material for "keeping away" moths was moth balls, the chemical name for which is naphthalene. Critical inspection of this jawbreaking paragraph-heading reveals that naphthalene is the last and, to most people, most easily recognizable element of this complex, which seems significant.

However, the big difference between the simple naphthalene and its later-day derivative is that, while both of them are insoluble in water, the six-chlorine compound is soluble in organic solvents of various types, which enables it to be used in the dyebath in emulsion form, from which it can be exhausted by the affinity that wool and it have for one another.

Gerald Laxer suggests that the use of this product in wool dyeing may be one other factor in accomplishing the production of a wool fabric possessing properties entitling it to be classed as an "easy-care" cloth.

Dr Laxer, who is director of science & technology at The Wool Bureau, Inc, has written a right good article on this subject in the October 31 number of the Canadian Textile Journal.

Incidentally, in the previous number of this interesting journal is a good picture of our old friend R Gordon Fiddes, whom we knew both at General Dyestuff, long years ago, and at Waumbec Manufacturing Company in Manchester, NH, fewer years ago. Now he is training the young Canadian dyer to shoot at perfection on Arnel, Celacloud, Celaperm, and Quilticel.

PERSONAE GRATAE

Just this morning we are reminded by two good friends that there are places where the temperature is 'way above the 7°F which the thermometer said it was when we arose at the crack of dawn to come to work. First, our respected chief Bert Royce, who tells us that it is 80° in the shade, where he is staying in Fort Lauderdale, Fla, and the other, Kelly Zillessen, who writes us from Christchurch, Barbados, where he is watching cricket matches, as long as he can stand it, explaining that "They are quite as difficult for me to understand as a game between the Condemned Yankees (translate ad libitum) and the Boston Red Sox would be to a chap just in from Manchester". Quate so, old chap!

In the same mail came a note from C J W Hooper bringing a couple of addresses of the German and French Standards Associations. Dr Hooper is the capable editor of the Journal of the Society of Dyers & Colourists. (No, Elmer, that's the way the English spell it).

Also from England, a nice handful of literature from L Peters, lecturer in the Department of Textile Industries of our alma mater, Leeds University. Dr Peters and his confederate C B Stevens are the men who devised the "New Approach to Dyeing" involving the use of sparingly water-soluble dyestuff solvents, which we have previously mentioned in this and other places. We have been asked for copies of these papers and some correspondence arising from their publication. Now we have them.

TAXATION

Chief Justice Marshall once said "The power to tax involves the power to destroy".

This brings to mind another quotation, the saying of a very different type of person, Lord Byron. It goes thus, "A thousand years scarce serve to form a state; an hour may lay it in the dust".

"If we won't discipline ourselves the world will do it for us'', said that celebrated and witty industrial writer, Wm Feather.

Finally here is a quotation from Grit . . . "The government deplores the fact that the outgo of 28% of American families exceeds their income. Look who's talking!" —Q.E.F.

Abstracts

Flameproofing of Textile Fabrics, with Particular Reference to the Function of Antimony Compounds

Read, N J and Heighway-Bury, E G, *J Soc Dyers Col* **74**, 823-9, Dec, 1958

The authors state that three durable flameproofing processes for textiles have reached the stage of commercial development in recent years. *Proban* is based on tetrakis hydroxymethyl phosphonium chloride. *Lifeguard* is based on a combination of oxy compounds of titanium and antimony. The most recent process to come on the market employs antimony oxide and a chlorinated compound.

Flameproofing processes have generally been developed for cotton fabrics, since the fire risks associated with these materials constitute a serious drawback. They fall into two categories: temporary and durable (fast to laundering).

The requirements of an ideal flameproofing process may be summarized as follows:

1) A minimum "add-on" is desirable, to avoid excessive increase in weight.

2) Satisfactory hand of flameproofed fabric.

3) Ease of application, important because of its effect on cost of manufacture.

4) Good resistance to laundering and drycleaning.

5) Freedom from detrimental action on the material.

6) No decrease in transmission of vapor caused by filling the pores in the fabric.

7) No harmful physiological effects.

8) No increase in the afterglow (flameless combustion of the material).

It must probably be admitted that no flameproofing process has yet been discovered which fulfills all the ideal requirements.

The authors discuss several theories which attempt to explain the mechanism of flameproofing.

Antimony oxide was used extensively during World War II, as it was found to be sufficiently effective to prevent ignition of camouflage scrim by gun flash. Although antimony oxide alone has only a limited effectiveness as a flameproofing agent, antimony oxychloride has for a very long time been recognized as an effective flame retardant; but it cannot be used to flameproof textiles because it easily hydrolyzes to yield hydrochloric acid, which destroys the fabric, particularly cottons.

Much progress has been made by combining with antimony oxide certain chlorinated organic compounds (eg, polyvinyl chloride) which yield hydrochloric acid when decomposed by heat and react with the antimony oxide to produce antimony chloride *in situ* only at the ignition temperature of cellulose.

The authors describe the advantages of antimony chloride as a flameproofing compound (low melting and boiling points, low cost, ease of application, nontoxicity, and ability to withstand drycleaning and laundering.

The preparation and application of a typical emulsion (now in use) of antimony oxide plus a chlorinated substance (polyvinyl chloride latex) is described, also the influence of this treatment on the color, hand and strength of the cotton fabric.

An experimental demonstration of the mechanism of the flameproofing effect of antimony chloride is also described.

Ten references to the literature are cited.

Water-repellent Finishes—Modern Use of Silicones

Madaras, G W, *J Soc Dyers Col* **74**, 835-41, Dec, 1958

The author reviews the development of silicon compounds since 1901, and describes the chemistry of the "silicones" (built up of alternating Si-O-Si-O atoms).

Commercial products made from silicones had firmly established themselves in the USA by 1949, and were beginning to be looked upon less as a chemical curiosity in England. Initial outlets were as insulating materials in the electrical industry, but their usefulness as lubricants and greases won them admission into many branches of engineering, while their water-repellent property is now utilized by a variety of industries, eg, building, textile and leather.

Application of a silicone fluid or resin to any surface renders the latter powerfully water-repellent. Linear dimethylpolysiloxane fluids which exhibit this effect are the prototype of the silicones which are of most interest to the textile industry.

The application of these compounds alone to textiles is not feasible, since they require heating at 200-250°C for several hours to make them water-repellent. If certain reactive groups (eg, hydrogen) are introduced into the molecule, however, products are obtained which are particularly suitable for textile application and are still the most widely employed, it is said.

To obtain satisfactory polymerization or hardening of the silicone fluid on the fiber surface, the use of catalysts is required. A number of metal compounds have been found suitable for this purpose, including the fatty acid salts of lead, tin and zinc, as well as certain organic titanium compounds (eg, butyl titanate). The titanium catalysts exert their effect at low or even room temperature, and even bring about a satisfactory union between the fiber and the less-reactive silicones.

The application of silicones to textiles falls broadly into two groups: 1) application from organic-solvent solutions; 2) application from aqueous emulsions. The organic-solvent method has the advantages that it can be applied to *all* fibers; that no swelling of the fiber occurs; and that no emulsifying agent is needed (which might impair the proofing). However, since organic-solvent treatments are not favored by the textile industry, the silicone manufacturers have met its needs by supplying their products in the form of aqueous emulsions. The author describes in detail the latest developments in these emulsions. He also refers to methods for testing water repellency, and compares the Standard Spray Test with the Bundesmann Test, the latter being more severe.

In his conclusion he states that, if strict comparisons are made, the initial water repellency is almost always found to be superior with silicone-treated fabrics than with other proofing methods, and this relation continues throughout the life of the fabric.

Flame-resistant Finishing of Cellulosic Fabrics with Phosphorus-containing Resins

Perfect, J R W, *J Soc Dyers Col* **74**, 829-34, Dec, 1958

It has been known for many years that certain phosphorus-containing compounds can be applied to cellulosic fabrics to make them resistant to burning. Ammonium phosphate has been widely used in treatments of textiles and wood, and various other phosphorus compounds have been suggested from time to time.

All finishes based on phosphorus-

containing compounds have one common property: they make the fabric resistant to smoldering (afterglow), and even if insufficient finish is applied to prevent the fabric from burning, the residue will not be ash but a black char, a skeleton of the fabric, which is extremely resistant to prolonged fierce heating.

Finishes based on soluble phosphates are not fast to washing. Efforts to obtain more permanent effects by fixing the phosphorus on or in the fabric are described in this paper. The following methods are discussed:

1) Treatment with ammonium phosphate plus dicyandiamide, followed by heat-curing. This treatment resists water but not hot soaping. It has been used on upholstery fabrics.

2) Treatment with phosphoric acid plus urea, cyanamide or other amines, followed by heat-curing. This process gives good flame and glow resistance but loses its effect on repeated soaping, and the fabrics lose strength.

3) Direct phosphorylation of the fibers with phosphoryl chloride, followed by amidation. This process has not been commercialized.

4) Application of a phosphorylamide (made by reacting phosphoryl chloride with ammonia). This treatment has good flame resistance and stands repeated mild washing, but there is considerable loss in tear strength.

5) Combining phosphorus on cotton with thermosetting resins. Various attempts in this direction have been made, but none have been developed commercially.

6) Application of tetrakis hydroxymethyl phosphonium chloride (THPC) to cotton, together with urea and a methylolmelamine, followed by baking at 142°C and treatment with a hot detergent. This treatment resists flame and stands repeated washing and drycleaning. The "Proban" finish is based on this process. The chemistry of the THPC reaction is described at considerable length.

7) Use of a brominated triallyl phosphate polymer. This process is expensive and difficult to apply.

8) Treatment with an aqueous emulsion polymer of bromoform and triallyl phosphate (BAP). The preparation of the emulsion is described. Fabrics so treated have good resistance to flame and glowing, and the finish is fairly fast to washing. The fabric strength is not much affected.

9) Combination of THPC and BAP. This is said to have advantages over either of the separate treatments (better flame resistance and less loss in tear strength).

The mechanism of the flame- and glowproofing action of phosphorus compounds is described in much detail.

Thirty-four references to the literature are cited.

The Influence of Fiber Types on Dyeing Methods (14th John Mercer Lecture)

Ward, J S, *J Soc Dyers Col* **74**, 813-23, Dec, 1958

An account is given of the many factors which influence the dyeing method adopted for a particular fibrous material. This abstract will attempt to cover only a few of the items discussed in this excellent paper, which should be read in its entirety.

Fibers vary widely in the rate of diffusion of dyes into them from aqueous dyebaths. At a given temperature, the rate depends upon the relative sizes of the dye molecules (or particles) and the channels in the fiber through which they must pass. The larger the dye and the smaller the channels in the fiber, the more difficult it is for the dye to diffuse into the fiber. Diffusion rates are influenced greatly by temperature; the higher the temperature, the higher the rate. Dye molecules in solution vary approximately in the following order of increasing size: disperse dyes, leveling acid dyes, Indigoid leuco-vat dyes, basic dyes, anthraquinone leuco-vat dyes, aggregated acid dyes, metal-complex dyes, direct dyes.

Dry fibers all have relatively compact structures; on wetting, the structure opens to an extent depending on fiber type. The channels which are formed vary in the following order of increasing size: Terylene, Tricel, Orlon, Dicel, nylon, Perlon and wool, viscose rayon, cotton, Fibrolane.

Nearly all known dyes diffuse into cotton, viscose rayon or Fibrolane at 100°C. Only the smallest disperse dyes diffuse into Terylene at this temperature. The other fibers exhibit intermediate behavior.

Regarding the effect of the dyebath temperatures, the author includes a table listing the approximate temperatures necessary for adequate diffusion of the different classes of dyes into the ten fiber classes mentioned (eg, for disperse dyes, 20°C for cotton and rayon; 110°C for Terylene).

Regarding the affinity of a dye for a particular fiber, the author tabulates both the affinity and the diffusion rate of different dye classes on the various fiber types (eg, disperse dyes on Terylene, acrylics, acetate and Orlon). The saturation absorption of several disperse dyes on the various hydrophobic fibers is also tabulated.

Uniformity of dyeing and the causes of unlevelness are discussed at great length. In this connection the author refers to the advantages of the padding method of dyeing. If the impregnation is uniform, this method overcomes many of the difficulties resulting from unequal exhaustion.

The author also discusses the mechanical and chemical behavior of the various fibers during the dyeing process (possibility of dimensional changes, saponification, etc).

Ten references to the literature are cited.

Relationship of Age to Color Vision

Lakowski, R, *Dyer* **120**, 789-90, Nov 21, 1958

The relationship of age to color discrimination has been investigated, to find out whether there are any changes in color perception due to age. Over 500 persons have been tested, the age range being from 5 to 90.

From data collected, there appear to be distinct phases in the development of color vision. Colors are perceived most readily and most accurately between 16 and 35 years of age. In age groups 5-15 and 35-55 (approx) the percentages of people with good color discrimination are much smaller. After approx 55 there appears to be a rapid deterioration in the number who are capable of fine discrimination, falling as low as one in ten.

Of the various forms of color-blindness, it was found that the so-called "red-green" vision is least affected by age deterioration and remains very stable until the 55-plus age group is reached. On the other hand, "yellow-blue" and "violet-blue/green" vision deterioration sets in as early as 30 years of age and increases steadily in each successive age group.

It must not be concluded from the above that many people over 50 are "color-blind". This term is very misleading, for there are very few people who see no colors at all. The research does show, however, that with advancing years there is a relative lessening in the ability to discriminate colors, especially in yellow-blue and violet-blue/green. In view of the extent of such deterioration in people over 50, the author recommends testing at short age intervals all those involved in work requiring fine color discrimination and accurate color matching.

News of the Trade

BFG Chemical Announces Textile Lab Completion

Installation of a new laboratory for textile research and development has been completed at the Cleveland headquarters office of B F Goodrich Chemical Co.

According to Harry B Warner, vice president of marketing, the laboratory is equipped with virtually every type of textile processing equipment necessary for the creation of yarns and testing of products made from Darvan dinitrile fiber, one of the newest of the man-made textile fibers.

The air-conditioned, humidity-controlled laboratory occupies a floor and a half of the recently acquired Chester Avenue annex located adjacent to the company's headquarters office. Approximately 13,000 square feet of usable space have been provided for the laboratory, which is designed to fulfill three functions. Prime consideration is given to providing technical service to customers and potential customers, particularly in the area of new fabric constructions. Secondly, the laboratory handles the quality control of Darvan fiber produced at the Avon Lake, Ohio semiworks plant. The third function is in the field of long-range development work, which involves the testing and evaluation of new fibers and fiber modifications, experiments with blends with other fibers, and the accumulation of basic data to be made available to the textile industry.

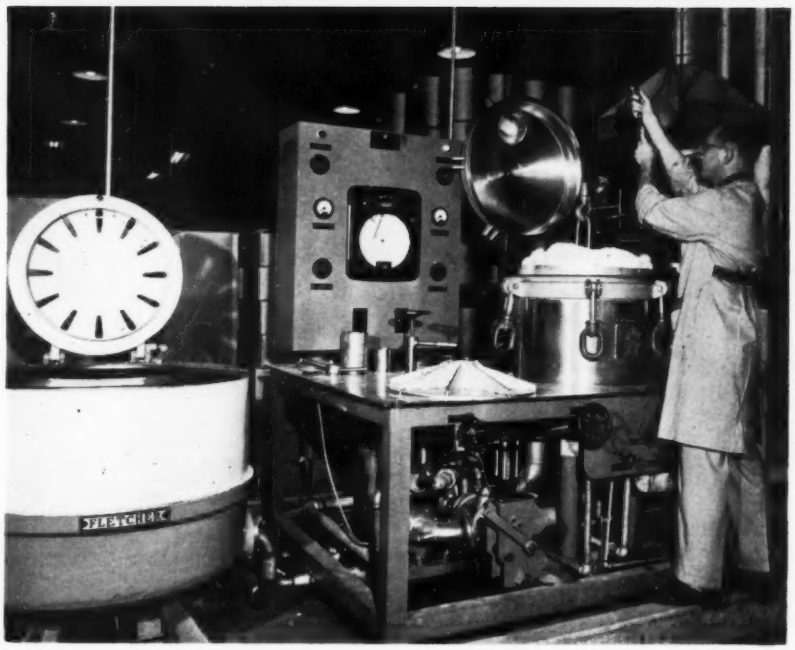
"We feel we are well-equipped for development work particularly in the knitwear field," Warner said. "For example, our equipment permits us to go all the way from a bale of fiber to a finished sweater."

The new laboratory contains facilities for the spinning of yarn by both the short staple cotton system and the long staple modified worsted system.

Included in the laboratory are a Turbo Perlok machine for direct tow-to-top conversion; both a cotton and a worsted card; drawing, roving, and spinning equipment to process yarns ranging from 5's to 70's worsted count; and sweater and jersey fabric knitting machines in several gauges.

Dyeing equipment includes facilities for stock, skein, package, and both paddle and beck dyeing.

Among the laboratory units for the testing of yarns and fabrics are pilling and abrasion testers, a uniformity analyzer, and an automatic single and yarn tester.



INCLUDED IN THE DARVAN laboratory facilities is equipment for stock, skein, package, and both paddle and beck dyeing. Shown above is a 50-pound capacity pressure kettle for either stock or package dyeing of Darvan dinitrile fiber produced by B F Goodrich Chemical Company.

Both home and commercial laundry and pressing equipment have been installed.

Fourteen experienced textile technicians are currently employed to operate the new laboratory, Warner said.

Cyanamid Breaks Ground for New Anthraquinone Facility

Ground was broken at Bound Brook, NJ, by American Cyanamid Co for a multi-million dollar anthraquinone manufacturing facility which reportedly will double Cyanamid's annual production of this chemical.

The new plant, which will replace and expand existing anthraquinone facilities, will also provide additional production capacity for making methyl anthraquinone, naphthoquinone and phthalic anhydride. With its completion, Cyanamid reportedly will become the only commercial producer of naphthoquinone in this country.

Anthraquinone is an intermediate chemical used primarily in the manufacture of dyes, while napthoquinone is used in making fungicides, algaecides, plastics, pharmaceuticals, and photographic materials.

Methyl anthraquinone is used in making dyes and in processing drying oils, and phthalic anhydride is used to make dyes, pigments, rubber chemicals and alkyd resins for surface coating.

An outdoor-type continuous processing installation with panel-board control, the new plant will cover approximately two acres and will use a completely new manufacturing process developed in the company's research laboratories. Known as the naphthoquinone process, it involves the direct oxidation of naphthalene in a fixed bed catalytic converter.

Development work on the process has been in progress for the past six years. Its practicality has been successfully demonstrated in pilot-plant operations.

Design and construction of the new plant will be under the supervision of the company's Engineering and Construction Division. It is expected to be completed late this year. Design provides for expansion in the future.

The new unit, a part of the Bound Brook plant, will be operated by the company's Organic Chemicals Division.

VDI '59 Theme—"Color Makes the Difference"

Coordinated promotion efforts to stimulate the greater use of color in apparel and home furnishings fabrics highlight the 1959 program of The Vat Dye Institute.

Adopting as its theme "color makes the difference," the association's advertising and educational activities are designed to serve as a positive influence for the introduction of color in many textiles not using any dyes, according to Henry Herrmann, executive secretary.

A principal aim of the drive is to help stress the styling of less white goods and to play up the fashion desirability of colored fabrics, especially in the deeper pastel shades, Mr Herrmann reports.

Initial phase of the campaign will be a series of six ads in which leading mill and apparel manufacturers will be quoted on the importance of color in their style and merchandise planning.

In addition to its regularly scheduled educational campaign, the Institute will continue to work with other trade and consumer groups, as well as home economists, teachers and government service specialists interested in building color quality.

CCDA to Sponsor Seminar on Diversification

The Annual New York open meeting of the Commercial Chemical Development Association, which will be held on March 4 and 5 at the Statler Hilton Hotel will have as its theme "Diversification in the Chemical Industry."

As announced by C A Setterstrom, program chairman, the March 4 session will be a Seminar on Diversification. A series of seven separate panel discussions by leading authorities in the chemical industry will be held. In the morning the general theme of diversification will be developed, while in the afternoon the discussion will cover specific subjects including detergents, intermediates, chemical specialties, plastics and plasticizers. These discussions will be informal with ample opportunity for audience participation. At the Luncheon on March 4, Willis J Winn, dean, Wharton School of Finance and Commerce, Univ of Pennsylvania, will discuss "Training for Management." At the completion of the March 4 program there will be a social hour and the Annual Banquet, which will feature the presentation of the 1959 CCDA Honor Award.

An unusual program is planned for March 5. In the morning session all registrants will have an opportunity to participate in small groups in a case study of plans for diversification of a hypothetical chemical company. In the afternoon alternate solutions will be presented to a simulated meeting of a board of directors with prominent executives playing the roles of directors. The final decision of the board will be presented to a "shareholders' meeting" consisting of questions and discussions from the floor.

The luncheon speaker on March 5 will be Wallace Brode, Science Advisor to the Secretary of State, who will speak on "International Aspects of Science."

Allen to Discuss Optical Bleaches at TRI Seminar

E M Allen, American Cyanamid Co, will speak on "Optical Bleaches" at the March 5 Seminar of the Textile Research Institute, Princeton, NJ. He will discuss the chemistry and optics of fluorescent whitening agents used in textile, soap, and allied industries.

Future seminars are scheduled as follows:

March 19—"Orientation of Crystalline Polymers"—R S Stein, Univ of Mass

April 2—"Dyeing Hydrophobic Fibers"—F Fortess, Celanese Corp of America

April 16—"Low Temperature X-Ray Studies on Polymers"—J H Wakelin, TRI

May 7—"Extension of Elastic Filaments"—R Chicurel, TRI

May 21—"Seed Hairs and Bast Fibers"—T E Timell, Pulp & Paper Research Inst

All seminars are on Thursday, and will be held at the TRI Laboratories at 2:30 pm.

Advance notice of planned attendance to L Rebenfeld, TRI, will be appreciated.

IMPORTANT NOTICE

IN order to comply with current postal regulations, AMERICAN DYESTUFF REPORTER is required to change its method of page numbering with this issue.

You will note that pages are now numbered consecutively throughout the journal, without distinction between advertising and text pages. Also, we are abandoning the practice of continuous numbering of text pages according to volume numbers.

All future numbers will be folioed consecutively beginning with page 1 each issue.

* * *

Your attention is called, also, to the fact that the December 15, 1958 issue was incorrectly numbered on the cover as No. 24, whereas it should have been No. 25. The other December 1958 issues were correctly numbered, ie, December 1 (No. 24) and December 29 (No. 26).

New Du Pont Sodium and Chlorine Unit Started

Startup of a new multimillion dollar sodium and chlorine unit at the Du Pont Company's Memphis, Tenn, plant was announced earlier this month by the company.

Completion of the new facilities reportedly increases Du Pont's capacity for these chemicals by about 50 percent, according to T D Bell, manager of the plant, which is operated by the company's Electrochemicals Department. Previously, both products were produced only at the Niagara Falls, N Y, plant.

Mr Bell said the additional sodium capacity is expected to supply the need for the basic metal in chemical processing.

Part of the additional chlorine capacity will be used in the manufacture of titanium dioxide pigment at Du Pont's new 45,000-ton capacity plant now nearing completion at New Johnsonville, Tenn. The plant will produce chloride-type pigment by a process resulting from Du Pont's research program.

Mr Bell said two other major projects are nearing completion at the Memphis plant and should be in operation about midyear. These include a plant to produce Oxone monopersulfate compound, a new solid peroxygen bleaching agent, and increased production facilities for hydrogen peroxide. The three projects have created about 200 new jobs at the plant, which also makes sodium cyanide and hydrogen cyanide.

Hummel Offering Magnesium Carbonates

Hummel Chemical Co, 90 West St, New York 6, NY, is now offering magnesium carbonates. The material is a light technical grade suitable for the manufacture of dyestuffs.

A technical data sheet and further information are available from Hummel on request.

Bart to Address Ontario Section CATCC

The March meeting of the Ontario Section of Canadian Association of Textile Colourists & Chemists will be held on Friday, March 6, at Macdonald Hall, Ontario Agricultural College, Guelph, Ontario. The guest speaker will be K C Bart of the Dyestuffs Division Technical Service, Ciba Co Ltd, who will address the meeting on the subject of "Reactive Dyes".

• NEW PRODUCTS AND DEVELOPMENTS •

Catalyst TT

The Chas S Tanner Co, Providence, RI and Greenville, SC, has several patents pending on a new catalyst known as Catalyst TT which, it is claimed, when used with urea-formaldehyde paste resin, methylated urea-formaldehyde resin, dimethylol ethyleneurea, methylated melamine-formaldehyde, and triazone, increases the tear and tensile strength on cotton fabrics 15 to 40%. It is also claimed to have better nonyellowing properties.

Tanner reports that, due to the unusual nature of Catalyst TT, a reasonable over-curing will not cause tendering, which gives maximum flexibility in processing resin-treated goods.

Best results on tensile and tear reportedly are obtained at the higher concentrations. It is claimed that there is also less odor development.

Zimcor Process

Zimmerman Associates, Guilford College, NC, has announced the introduction of its new Zimcor process for purifying catalysts employed in the curing of textile resins. This process is now being used in the manufacture of a complete line of pure catalysts for the textile trade, it is stated. Among the advantages claimed for the catalysts are better tear strength, nonchlorine-retentive properties, no odor, and no afterwash required.

Deriphats

Commercial availability of a new line of amphoteric surfactant products—trade-marked the Deriphats—has been announced by the Chemical Division of General Mills. The Deriphats are salts of N-alkyl beta-aminopropinates possessing both cationic and anionic functionality.

It is claimed that the dual nature of these amphoterics provides, in a single surfactant, adaptability to both acidic and alkaline media. All Deriphats reportedly are excellent corrosion inhibitors and detergents, while some are effective foamers and wetting agents.

The Deriphats have undergone extensive development testing and are the result of General Mills' continuing research program in fatty nitrogen derivatives. In addition to the Deriphats, the division also produces fatty nitrogen compounds, Versamid polyamide resins, Genamid epoxy curing agents, and sterols.

Clarity, light weight, strength, and impermeability all contribute to the versatility of polyethylene film in solving many of the problems inherent in bleachery operations at Lowell Bleachery, Inc, St Louis, Mo

Versatility of Durethene Polyethylene Film Cited at Lowell Bleachery

Lowell Bleachery, Inc, 7710 Polk Street, St Louis, Mo, is taking advantage of three of the different characteristics of polyethylene film to assist in solving three of its most difficult operating problems. Durethene Polyethylene Film, a product of the Plastics Div, Koppers Co, Inc, is utilized by Lowell as a room divider, as covers for the bleaching vats, and as covers for its large skids.

As a room divider, the film serves as a temperature barrier between the compressive shrinkage room—where the temperatures are maintained at approximately 140°F—and an adjacent work area. It is claimed that, in addition to minimizing the heat problem, the clear film transmits light, making the use of additional lighting fixtures in each area unnecessary.

It is reported that, because polyethylene film is unaffected by the chemical action of strong bleaches, Lowell is using it as a vat cover during bleaching operations. In this application, the film is said to prevent the evaporation of the expensive bleaching chemicals and to eliminate the possibility of discoloration of fabrics only partially submerged near the surface of the vat.

In view of the conditions of high humidity that are prevalent in bleachery operations, moisture damage is a constant threat, particularly where fabrics must be stored for any period of time. Dust is also an almost unavoidable circumstance. To protect fabrics in storage, Lowell utilizes polyethylene film as skid covers, and finds it offers excellent protection to all fabrics.

Officials at Lowell have expressed complete satisfaction with this film, which, it is stated, because of its low cost and reuseability, gives them an economical means of solving or avoiding many of the problems inherent in bleachery operations.

Alfols

Development of a new process for manufacturing straight-chain primary alcohols from petroleum has been announced by Continental Oil Company's petrochemical department. The new chemicals will be marketed by Conoco under the trade name of Alfol.

The Alfols range in chain length from six carbon atoms up through 18 carbon atoms or higher if desired. It is reported that all contain even numbers of carbon atoms and most have been available in the past only from conventional processes using natural oils and fats as the starting materials.

Plans are now being made for the installation of a commercial-scale plant of multimillion-pound annual capacity for the manufacture of Alfols at Ponca City, Okla.

Alfols will find use in the manufacture of such products as synthetic detergents, emulsifiers, textile chemicals, etc.

Lauravel SC

While declaring that its nonionic softener, Lauravel SC, gives a finer finish to all types of yarns and fabrics, Laurel Soap Mfg Co claims that the product is outstanding for cotton goods, on which it is said to bestow a full-bodied softness and to resist aging while not altering shades or yellowing whites.

Lauravel SC is said to have gained popularity for its resistance to salts, acids, and alkalis. It is reported stable in salt, Epsom Salt, and acid-chrome finishing baths, and may under certain conditions be used in 1% to 2% salt solutions. This characteristic, it is claimed, makes Lauravel SC ideal for softening many direct colors where a salt color fixative is used.

Lauravel SC is said to be highly compatible with other finishing agents, such as resins and dextrines, and fabrics finished with it are also said to show excellent resistance to scorching. Used as a top softener in resin-treated goods, it reportedly is stable to residual products in the goods. Laurel further states that the softener gives superior lubrication to improve sewing and cutting properties, aids napping characteristics, and when used to replace conventional oils and softeners in compressive processes, gives a far less limp and raggy hand.

Lauravel SC is said to be easy both to prepare and apply, as its soft liquid paste is dispersed readily in hot water and added to the last rinse. In finishing mixes, it reportedly may be added directly to the batch and boiled up with the other ingredients. It is applied with virtually any kind of equipment, according to the manufacturers report.

For further information, write to Laurel Soap Mfg Co, Inc, Tioga, Thompson & Almond Streets, Philadelphia 34, Pa.

• NAMES IN THE NEWS •

Werner

Jesse Werner, formerly director of commercial development for the Company's Dyestuff & Chemical Division, has been elected a vice president of General Aniline & Film Corp.

Dr Werner, who is the author or co-author of some 45 publications and patents on various phases of organic chemistry and chemical engineering, became associated with General Aniline in 1938 as a research chemist.

Verona-Pharma Chemical Corporation, Union, NJ, has announced the following changes in company officers:

E M Pflueger has been elected chairman of the board of directors;

H L Urban has been elected president of the Corporation.

F J Hobin, formerly New England Division manager for Armour & Company Industrial Soap Division, has joined the Textile Chemical Department of E F Drew & Co, Inc as a technical sales representative. Mr Hobin will cover the Rhode Island, Massachusetts and Maine territory.

Ellis Abrams has been promoted to assistant manager of research by E F Houghton & Co, Philadelphia, Pa.

Responsibility for supervision of textile, paper, and organic research goes to Dr Abrams, who was formerly supervisor of organic research.

Kieffer

Weidmann

William H Kieffer and **Charles J Weidmann** have been elected vice presidents of the Ciba Co, Inc.

Mr Kieffer, who will retain his position as general sales manager of the dyes division, came to Ciba in New York in 1950, after having been associated with Ciba Co Ltd in Montreal for a number of years. Mr Kieffer also worked for American Cyanamid Co prior to joining the Ciba organization.

Appointed technical director of Ciba Co Inc in 1953, a position which he will continue to maintain, Dr Weidmann was previously associated with Ciba Co Ltd in Montreal and other Ciba companies abroad.

George O Linberg has been named executive vice president of Melrose Chemical Corp, Melrose, Mass, where he will work in close collaboration with James Warr, president and treasurer, to implement the 46-year-old Company's expansion program, which was inaugurated in September, 1958.

Mr Linberg will devote much of his time to the application of the line of permanent finishes developed by the Company.

Mr Linberg was formerly vice president and New England sales manager of Synthron, Inc, Ashton, RI. He is a past president of AATCC, having just completed his second term, past president of the Drysalters Club of New England, and a member of various technical societies.

Emerson

The Hellwig Dyeing Corp, Philadelphia, Pa, has announced the appointment of **Milton K Emerson** as manager of the Fabric Division.

Mr Emerson recently resigned from United Piece Dye Works, with whom he has been associated for the past twenty-five years. At the time of his resignation he was vice president of the Company and general manager of the Charleston, SC, Division.

Appointment of **Solon D Fisher** as manager of the St Louis, Mo sales branch, Solvay Process Division, Allied Chemical Corp, became effective February 1st. Mr Fisher succeeds **Elmer J Seener,** who is retiring after more than forty years with the Company.

Mr Fisher, who joined Solvay in 1948 and was assigned to the St Louis branch as a salesman, was transferred in 1955 to the Sales Department's Central Office in New York as technical assistant to the manager of the Special Chemicals Section.

R G D Dalton, formerly associated for many years with United Indigo and Chemical Co, Boston, Mass, has joined the sales staff of the Organic Chemical Corp, East Providence, RI, and Charlotte, NC.

Mr Dalton will travel his regular territories of New England and Canada.

Herbert F Schiefer has been appointed chief of the Textiles Section of the National Bureau of Standards, succeeding **William D Appel**, who retired January 31 after 30 years service as chief of the section.

Dr Schiefer is noted for his pioneering research in the measurement of physical properties of textile fibers, yarns, and fabrics. He has designed and developed instruments for evaluating the characteristics of various textiles, and a number of these instruments are widely used by the textile industry today.

Mr Appel is well known for his research on the properties and performance of dyes and dyed materials; the physical, chemical, and biological properties of textile fibers; and on textile test methods. Prior to joining the Bureau, he had been a research chemist in private industry.

Born in Washington, DC, in 1892, Mr Appel received his BA with honors in zoology and chemistry from the University of Chicago in 1917. He also was awarded an honorary M S by the Lowell Technological Institute.

Following his retirement, part of Mr Appel's time will be spent editing the annual *Technical Manual of the American Association of Textile Chemists and Colorists*. He will also serve the Association as co-ordinator for supplements to the *Colour Index*.

In a long and distinguished career, Mr Appel has received awards from the AATCC, the American Standards Association, the American Society for Testing Materials, and the U S Departments of Commerce and Army for his outstanding contributions to the textile field.

The author or co-author of nearly 70 publications in his field, Mr Appel is a member of the American Association of Textile Chemists and Colorists (President, 1944-46; Olney Medalist, 1954), the American Chemical Society, the American Society for Testing Materials, the Society of Dyers and Colourists, the Textile Institute, the Textile Research Institute, the Textile Roundtable of Washington, the American Association for the Advancement of Science, the Washington Philosophical Society, and the Washington Biologists Field Club.

R M Guckes, Andreykovicz & Dunk, Inc, Philadelphia, has been elected chairman of the board after thirty years as a member of the board and twenty years as president and treasurer. **Millard N Wattis**, with this 97-year old dyestuff company for thirty-three years, has been elected president and treasurer.

Stearns

Pepper

Shaw

American Cyanamid Co has named **E I Stearns** technical manager of its dyes department, while naming **F L Pepper** western district manager and **W L Shaw** assistant district manager for the department.

A veteran of 25 years with Cyanamid, Dr Stearns has served as Chicago branch manager since 1956. He will return to the Bound Brook, NJ, area, where he will make his headquarters. Dr Stearns served as assistant chairman of the 1958 AATCC Convention, which was held in Chicago.

Messrs Pepper and Shaw will make their headquarters at Cyanamid's Chicago branch office, Cyanamid having enlarged its western dyes sales district to include the entire western half of the country. Mr Pepper has been with Cyanamid since 1932. Mr. Shaw has been with the Company since 1931.

Byne

J Miller Byne III has been assigned to the southern sales territory for Becco Chemical Div, Food Machinery and Chemical Corp, Buffalo, NY.

Mr Byne will operate out of the Charlotte office, traveling in North and South Carolina.

C Russell Gill has resigned as president of Southern Sizing Co, East Point, Ga.

Mr Gill has been active in AATCC, serving as chairman of the Southeastern Section, 1948-9, and National Councilor, 1950-1.

Apex Chemical Co, Inc, Elizabethport, NJ, has appointed **Steve Kowal** as its sales representative in the Carolinas. Mr Kowal was previously associated with Polymer Southern Inc and Burlington Industries. He is located at 1312 W Market St, Greensboro, NC.

The Silicone Products Department of the General Electric Company has announced the opening of a new Southeastern sales territory. **Joseph V Rizzo**, formerly assigned to the Department's Newark Office, has been placed in charge of this territory. Until a new sales office is established, Mr Rizzo will be located in the Silicone Sales Office, 1000 Tuckaseegee Road, Charlotte, NC.

Milton Harris, vice president and director of research of The Gillette Company and president of Harris Research Laboratories, was the guest speaker at the February meeting of The Chemical Society of Washington. This meeting was held jointly with the Washington Junior Academy of Sciences. The title of Dr Harris's talk was "Textiles—Catalysts in the Growth of the Chemical Industry."

The forthcoming retirement of **R E Greenfield**, vice president, manufacturing, has been announced by the A E Staley Mfg Co, together with some resulting administrative changes in the company's manufacturing division.

Dr Greenfield will retire March 1, after 33 years with the company.

William B Bishop Sr, was named general superintendent, effective Jan 1. He has been technical superintendent.

G James Dustin was named technical superintendent, and **W Robert Schwandt**, methods and materials superintendent, succeeding Dustin. Schwandt has been assistant superintendent of the dry starch section.

In Staley's industrial sales department, **John W Lusk Jr** has been named senior sales representative in the Philadelphia branch office area, and **Edgar J VanAllsburg** has been named technical supervisor in the New York branch office area.

Stetsky

Snider

Beatrice Stetsky has joined the sales promotion staff of Dow Corning Corp.

Miss Stetsky's activities will be concentrated in the women's fashion apparel field, where she will maintain close liaison between Dow Corning and its customers.

For the past four years, Miss Stetsky served as advertising and sales promotion manager at Burlington Narrow Fabrics Co and Mooresville Mills, both divisions of Burlington Industries, Inc.

Miss Stetsky will headquarter at the company's office at 600 Fifth Avenue, New York.

The Institute of Textile Science has announced the election by its board of directors of the following as Ordinary Members of the Institute during 1958: **E K Brickenden**, Canadian Industries Ltd; **Wilfred Hodgson**, Hamilton Inst of Technology; **J E Kelly**, Courtaulds (Canada) Ltd; **H A Kraessig**, Industrial Cellulose Research Ltd; **Harold Lomas**, Canadian Aniline & Extract Co Ltd; **Alan G Newcombe**, Perritts & Spencer (Canada) Ltd; **W M Palmer**, Canadian Celanese Ltd; **Alan B Potter**, Ciba Co Ltd; **B Sutcliffe**, Courtaulds (Canada) Ltd; and **M R Wardle**, Du Pont of Canada Ltd.

Hodag Chemical Corporation, Chicago, Ill, has formed a Technical Services Department, which will be headed by **Yash Snider**, research chemist. Hodag formulates and produces antifoam agents and surface-active chemicals.

Norman R Cox, Robert G Kelso, and **Fred W Stone** have been appointed group leaders in the Development Department of Union Carbide Chemicals Co, division of Union Carbide Corp, at South Charleston, W Va. Mr Cox will work on process development on a pilot-plant scale, and Drs Kelso and Stone will work on process and product development.

Recent additions to Development include **John R Nazy** and **Ronald A Thursack**.

Ciba Co, Inc has announced the selection of the following men for new and renewed Ciba scholarships at their respective colleges: **Robert Davis**, Lowell Technological Institute; **Hollis E Crowe**, Univ of Maine; **Ronald F Fleming**, Univ of Washington; **Ronald Luongo** and **Sidney L Barkoff**, Philadelphia Textile Institute; **Jimmie Morris Hester**, Georgia Inst of Technology; **Robert H Barker** and **Mack E Atkinson**, Clemson College; **Daniel F Ward** and **Charles E Rickell**, North Carolina State College.

OBITUARY

CARL A PULLER, 81, consultant for Pfister Chemical Works, Inc, died December 18 at Hackensack Hospital, Hackensack, NJ, following a fall on ice which resulted in a broken hip and other complications.

Born in Krafeld, Germany on Dec 29, 1876, Mr Puller received his schooling at the Realgymnasium and the Imperial Textile & Dyeing Institute in Krafeld, and spent one year in the German Army in Berlin.

He obtained his first industry experience in a silk dyehouse owned by the Puller family in Krafeld, the C E Puller Silk Dyeing Co, which is believed to have been the first in the world to do tin weighting on silk. He also worked for Gillet at Lyons, France; Castena in Milan, Italy; the Weidman Silk Dyeing Co, Tahlviel, Switzerland; and Schetty Bros, Basle, Switzerland before coming to the United States in 1900 to take a position with Weidman Silk Dyeing Co in Paterson, NJ.

In 1916, Mr Puller joined the William Beckers Chemical Co, Brooklyn, NY, as a demonstrator and dyestuff salesman. This firm was integrated eventually into National Aniline. Prior to joining Pfister Chemical Works, Inc in 1939, he also spent some time with Ciba Co, Inc, also in the capacity of demonstrator and salesman.

* * *

CHARLIE WATERS, an active member of the Southeastern Section, AATCC, died January 23 at Ft Myers, Fla.

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